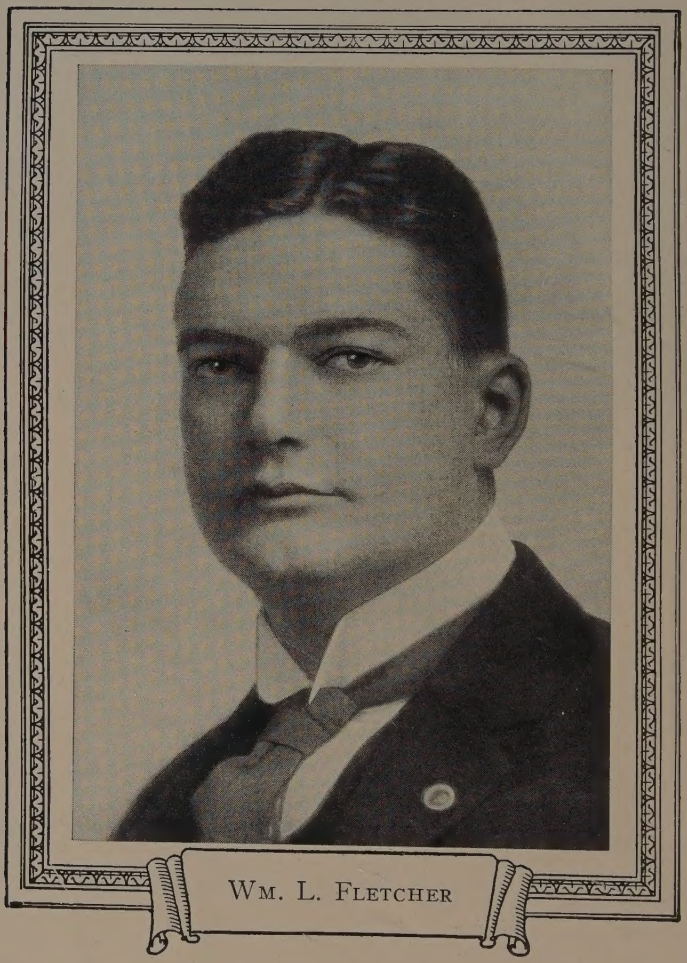

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THE CUMULATIVE LOOSE-LEAF BUSINESS ENCYCLOPEDIA

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VOLUME II

PRODUCTION

By E. H. Fish, B.S.

PERSONNEL

By Wm. L. Fletcher

COST ACCOUNTING

By J. Lee Nicholson, C.P.A.

In Ten Volumes

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PRODUCTION

AGRICULTURE

With the production-control program for agriculture yielding unsatisfactory results, officials of the Department of Agriculture in recent weeks have been suggesting first one scheme and then another in a determined effort to establish a really effective program.

Re-enactment of certain processing taxes on our principal farm products, similar to those outlawed by the Supreme Court of the United States in 1936, and a "two-price" system under which families in the "depressed third" of the population would obtain farm products below prevailing quotations, the Government to stand all losses, are among the new schemes put forward by Secretary of Agriculture Wallace to aid the present program.

The Farm Act of 1938, designed and promoted largely by Secretary Wallace and heralded by him as fulfilling a "vital need" of the nation's agriculture, has been far from satisfactory, if we are to judge from the criticism of it by farmers and from the many new schemes being proposed to bolster or alter it.

In addition to the new plans by Secretary Wallace, Senator Kay Pittman, of Nevada, has suggested that the cotton surplus of 13,500,000 bales be exchanged for silver on the basis of ten pounds of cotton for an ounce of the metal. Senator Ellison D. Smith of South Carolina, chairman of the Senate Committee on Agriculture and Forestry, has been advocating an increase in the present lending rates by the Government on this year's cotton crop.

Low Level of Agricultural Prices

The sudden desire of Washington to aid the farmer further just now grows out of the fact that agricultural products generally are selling at their lowest level in history, in terms of gold. Despite the somewhat heroic efforts to control production, supplies are excessive. With the loss of a large part of the export markets for farm products, the prospects of an improved price structure does not appear imminent except through governmental aid or subsidies.

Loans "Without Recourse"

The present Farm Act, which is costing upward of $1,000,000,000 yearly, provides for limiting the acreage to be planted in cotton, wheat, corn, tobacco and rice, when approved by two-thirds of the growers of any of these crops. In addition, the co-operating farmers may obtain "without recourse" loans

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from the Government on a basis fixed by the Secretary of Agriculture. When the supply is above normal or the price is 52 percent below parity, the loans are made mandatory.

Already "without recourse" loans have been placed on cotton and wheat. Secretary Wallace also has announced that similar loans will be granted to the corn farmers, probably at 57 cents a bushel. In addition, an effort has been made to stimulate the movement of wheat in the export markets through the aid of government subsidies. On the 11,500,000 bushels sold in this manner through September 30, the difference between the price which the Government paid and the price which it obtained for the cereal averaged 12.6 cents a bushel.

Abandonment of Export Subsidiary Program

Apparently, this export-subsidy program now is to be dropped, or at least not extended to other farm products. Secretary Wallace stated that "if there is to be any dumping of surplus farm products, it will be done at home to help the lower third of our people rather than foreign countries."

Federal Farm Board's Efforts

At this point, it might be well to review briefly just what the United States Government has done with respect to aiding farm prices since the organization of the old Farm Board in 1929 under the Hoover regime. With the exception of a brief period during the World War, this was the first time that the Federal Government had adopted any ambitious agricultural program. At that time, The Farm Board pegged the price of cotton at 16¼ cents a pound and purchased large quantities of wheat to aid that market. After two years of operation, the Farm Board had exhausted its funds and in 1932, the price of cotton dropped to between 5 and 6 cents a pound and wheat to 45 cents a bushel.

Roosevelt Administration Tackles Problem

With the advent of the Roosevelt Administration in March 1933 the country embarked on a still more ambitious program to solve the farm problem. The Farm Relief Bill was enacted in May of that year. Among other items, it provided for the regulation of production and the levying of processing taxes on farm products to be paid as benefits to those farmers who consented to cut their acreage as provided in the Act. In an effort to balance production with demand, some 10 million acres of that year's

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growing cotton crop were plowed under. In addition, millions of pigs and cattle were bought by the Government and destroyed.

In 1934 the Bankhead Act was passed fixing the amount of tax-free cotton that could be produced in any one year. The Government set up the Commodity Credit Corporation, through which "without recourse" loans were granted to farmers on the principal crops. Finally, with the outlawing of the processing taxes and other features of the Farm Relief Bill in January, 1936, the Soil Conservation Act was passed which provided for outright subsidies to farmers who would agree to limit their acreage to be planted to a particular crop.

After five years of crop control and regulation and the expenditure of billions of dollars, the Government now finds itself right back to where it started with respect to farm surpluses. Prices still are unsatisfactory and are being maintained at present levels only through the aid of Government loans.

THE UNITED STATES COTTON PROBLEM

Although the South is the richest section of the country in natural resources, it has a more serious poverty problem than any other, according to an extended review of economic and social conditions in the South issued by the "National Emergency Council." The South is said to surpass any other section in variety of mineral wealth and soil products. Its cotton and tobacco crops have, moreover, a greater per acre value than any other field crop. The South's chief problem is, nevertheless, in its agriculture. The present cotton situation primarily affects the South, but ultimately may affect northern agriculture and become a truly national problem.

One paragraph from the Council's Report reads: "With 28 percent of the nation's people, it has only 16 percent of the tools with which people make a living; with over half of the country's farmers, the South has less than one-fifth of the nation's farm implements."

It is noteworthy that the showing of "tools" is much better for industry as a whole than for agriculture, and this accords with common knowledge. The cotton, woolen, and rayon mills of the South are as well equipped as those of the North, and so of the pulp, paper, lumber, cement, and steel mills, shoe and furniture factories, etc. On the other hand, agriculture in the South is largely devoted to cotton, for which but few and cheap tools are used. The rule everywhere is that workers aided by capital-

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equipment produce more than hand-workers, and get more pay, and that workers without such aid produce but little and get but little.

The South's Reliance Upon Cotton

For a long time American cotton dominated world markets. In the years from 1865 to 1900 our exports of cotton averaged twice the home consumption, and competition in foreign markets was negligible; but the World War worked many changes, and has had lasting effects upon cotton and cotton goods.

Under the stimulus of high prices, our cotton acreage reached the high point in 1925–1926, in each of which years the plantings were about 46,000,000 acres. Under the weight of the two crops the New York price broke to 12.2 cents, but with lower prices exports in the two crop-years aggregated 19,000,000 bales, and in 1928 the price rallied to an average of 20 cents. In 1929 the Federal Farm Board was established to support farm prices, and attempted to fix the price of cotton at 18 cents, but the price declined to 8¼ cents in 1930–1931, and when another 16,600,000 bales came in 1931 the price broke to a low of 5.3 cents.

In 1933 as a result of a change in policy to acreage restrictions, the Government bought and plowed under 10,000,000 acres of growing cotton. The 1937 crop was restricted to 34,500,000 acres, but perverse Nature gave a yield of 18,916,000 bales, another new record. The Government offered loans of 9 cents a pound on the crop, which supported the market, but it accumulated a stock of 7,000,000 bales, and this year the loans were reduced to the minimum permissible under the Farm Act, or 8.30 cents. The 1938 plantings were reduced under the allotment plan, by about 23 percent, but the present farm price is the lowest since 1932. There is, moreover, talk of another acreage cut next year.

Meanwhile, the foreign crop has more than doubled from the average production of the four years 1932–24, and it may rise higher if the United States is successful in raising the price. No one familiar with the cotton trade doubts that if the United States is willing to sacrifice its own cotton production to raise the world price, it will have a measure of success; or doubts that by so doing it will continue to be a diminishing factor in the world supply. Competition cannot be met successfully by backing away from it.

Cotton Goods Production

For many years the United States was an exporter of cotton goods, to Asia, South America, and around the Caribbean, the

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effect of which was to enlarge the home market for cotton. This trade has become negligible. The costs and prices of N.R.A. (1933–35) started an alarming stream of Japanese cotton goods into the United States. In 1935 President Roosevelt used his authority under the Hawley-Smoot act to raise import duties on these goods. Moreover, it cannot be forgotten that in December, 1936, the Cotton Textile Institute sent a Commission of five members, three of whom were representative of the South, to Japan, to request and urge the Japanese cotton goods manufacturers to limit their exports to the United States, and that the agreement thus obtained remains in effect today.

Furthermore, not only Japan, but many of the countries which once bought cotton goods from the United States, now are making cotton goods, and at much lower costs than they can be produced in the United States on the present wage and hour basis.

It is not strange that some Southerners, by instinct and training, consider the protective tariff the mother of iniquities, but we submit that the tariff is not the vital factor in the cotton problem. While it is true that trade relations with other countries require a two-way movement, the first condition of foreign trade is ability to meet foreign competition, in both quality and price. Our cotton is better in quality than most of its competitors, but the foreign quality is improving, and price may make up for quality. It is an old story that the per-acre-yield of cotton in this country might be better. Thousands of cotton-farmers produce above the average. Production may be increased by better seed, better cultivation, more adequate use of fertilizers, or by new and improved machine equipment, as Northern farmers have cheapened grain production. It is not too much to say that two important gains are possible, viz: the quality of American cotton may be improved and the cost of production may be reduced.

Competitive Fibers Affecting Cotton

Both the production of cotton in other countries, and the use of competitive fibers are increasing. There has been a rapid development of rayon "staple" fiber, a new cellulose product, made from rayon and spun on cotton spindles, which has created a great new branch of the textile industry of growing importance in the South. At first these fibers were thought lacking in strength, but have been improved until recently two leading makers of motor-car tires have claimed that cellulose cord is a preferred

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material. Rayon or "staple fiber" is woven with silk, cotton or wool, and the weaves are popular goods. In the long run sales may be increased by the greater variety, but in Italy, Germany, and Japan, for example, the use of cotton has been reduced. Japan, which has been the largest buyer of American cotton, has now become the largest producer of "staple fiber," and recently has prohibited imports of American cotton, except for use in exported goods. Her home consumption for a population of 70,000,000 is restricted to wood fiber or cotton of Asiatic growth.

Sharecropper Problem

The policy of cotton acreage curtailment has aggravated the sharecropper problem. This unfortunate class is being crowded out of agriculture when there is no place for it to go. The South needs a greater variety of industries exchanging products with each other—more of the industries that require capital, and will shift thousands of sharecroppers to payrolls. There is no limit to the employment that may be had by exchanging services.

All Agriculture Affected

Notwithstanding the losses indicated above, cotton exports still take one-half our crop, and are vitally needed. With a carry-over greater than the crop, and acreage down nearly half since 1926, the American cotton-farmer is being backed off the map. Moreover, if the South is to continue losing its foreign market for cotton, all sections of this country and all lines of business will be compelled to make costly adjustments for if Southern farmers are to grow less cotton, they must turn to other crops.

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PROFITS FOR THIRD QUARTER OF 1937

During the past month reports issued revealed that leading corporations in many lines of industry continued to increase their volume of business and net profits over those of last year. In a number of other industries and trades, however, and also in the railroads and public utilities, either the rising level of costs felt throughout the period, or the recession in activity, or both, caused the reports of numerous concerns to fall below those of a year ago.

In 265 industrial corporations combined net profits, less deficits, were approximately $343,000,000 in the third quarter of this year, as compared with $402,000,000 for the same companies for the preceding quarter, and with only $290,000,000 for the third quarter of 1936.

Rise in Operating Costs

Despite the generally higher level of sales in the first three quarters of this year there have been more widespread decreases in profits, caused, of course, by the sharp rise in operating costs this year. Wages have increased, hours have been shortened, prices of raw materials have risen, and taxes have been generally higher, including the unemployment and pension taxes on payrolls. The industries have not been able to pass on all their cost increases in prices, and profit margins per unit have been reduced. But falling profit margins are not necessarily depressing as long as the volume of sales is constantly expanding, so that the return on capital is maintained, but they become a major factor when the volume ceases to expand. Costs, including wages, taxes, and fixed charges, contain elements that are hard to adjust, and reduced sales, especially in a time of falling prices, therefore cause a greater contraction in earnings. If earnings decline seriously, the business situation is greatly affected.

Operating Costs Lagging Behind Volume of Sales

During the summer a large number of manufacturing, merchandising and railroad corporations issued reports which supplied further evidence that in many industries the operating costs have been rising faster than the volume of sales, and that as a result profit margins have been narrowed. In the years 1933 to 1936 there was a large increase in production costs caused by higher wages and shorter hours, but this was more than offset by the continued sharp gains in sales volume and the consequent lowering of unit cost, so that profit margins as well as dollar profits showed steady increases. This condition still exists in many

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industries, but in others, particularly the consumers' goods industries, the increase in volume has now settled down to around the normal rate of growth, and thus has fallen behind the rate of increase in costs for labor, materials and taxes.

Corporation Income for 1935

A preliminary report on Statistics of Income for the year 1935 has recently been issued by the Treasury Department, which shows that of the 91,644 manufacturing corporations in the United States, (excluding inactive corporations), 41.4 per cent reported net income, while the remaining 58.6 per cent of the total had no net income. Aggregate net income after taxes was approximately $2,115,000,000, while the deficits aggregated $666,000,000.

The World Steel Boom

During the fall of 1937 we were in the midst of the greatest peacetime boom ever experienced in the world's iron and steel industries. If the current rate of activity had continued, there would have been turned out this year 140,000,000 tons of steel, which would have exceeded the previous peak outputs of around 120,000,000 tons each in 1929 and 1936, and dwarf the pre-war output, which averaged only about 68,000,000 tons from 1909–13.

In the past five years the economic and political activities have greatly changed the outlook for the steel industry and for the raw materials used in its making. In 1932 the world steel industry, except in the Soviet Union and still younger nations, was burdened by what was believed to be a huge excess capacity, and steel scrap was a drug on the market. Today the output is almost 200 per cent above that of 1932; steel scrap is selling at about four times its 1932 price and is regarded as such a valuable national resource that its export is prohibited by a number of nations. In fact, several nations are rationing pig iron and steel among their industries, and other nations are regulating exports of steel products to prevent their industries from a too rapid price-rise at home.

The primary cause of this outburst of activity is the fact that there has been little expansion of the steel-making capacity during the depression years, and in the meantime the demand for new and improved industrial equipment has greatly increased. World industrialization has furnished a constantly widening demand for steel and iron products, and the industrialization embraces the entire mechanical progress stimulated by the last war, and so inseparably associated with the rise in the standard of living.

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Modern metallurgical and technological developments have begun to free the iron and steel industry from concentration near ample deposits of ore, cheap fuel, and mechanical energy, so that the steel industry is no longer concentrated in Western Europe and North America, but has spread eastward into Asia, which in 1936 made 80 per cent more steel than in 1929.

The Automobile Industry

The march of recovery was started by the automobile industry late in 1932, and it has been an unfaltering bellwether in all the intervening time. This year factory sales to the end of September have been 14 per cent above those for the nine months of 1936, and for September alone they ran 27 per cent ahead. During the first half of the year American automobiles were for the second time our principal export product, with cotton second, although competition with European production has become keener.

A survey of the production of automobiles during the depression shows that for 1937 we are nearing a record level:

1929	5,621,715 automobiles produced
1933	1,985,909 automobiles produced
1934	2,869,963 automobiles produced
1936	4,616,274 automobiles produced
1937	5,000,000 estimated production

Thus far the recovery of the automobile industry has led the way out of the depression, and its ever widening cycle of demand for additional quantities of steel, copper, cloth, rubber, and the other products used in making motor cars has been a primary force behind recovery.

There is an increased need for replacements, since the automobiles now in use average one-seventh greater age than the average for 1929, and during this coming year the automotive output for 1929, the year of record production, will be past due for replacement. The number of used cars available for resale is, moreover, decreasing. This means that the used car market will be better, and that there will be better trade-in values for those who want to buy new automobiles. Partly offsetting the expected increased demand are the tendency for stricter credit terms and the unknown factor, the price increase for most models.

The Automobile industry accounts for 14.5 per cent of the national income, paying out in 1936 over nine billion dollars of the national income, and creating employment for over 6,000,000 workers. The automobile industry is the largest purchaser of

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gasoline (89%); rubber (80%); steel (20%); plate glass (73%); nickel (29.7%); lead (34%); mohair (40%); and lubricating oil (52%); while it uses many other products, so that recovery in the automobile business inevitably means stimulation of a multitude of industries.

The automobile worker's wages have been high. In 1929, with less than 6 per cent of the workers in manufacturing establishments automotive employees received 7.4 per cent of the wage total reported by the manufacturing group. About 6.4 per cent of the workers being automotive in the first semester of 1937, they received almost 8 per cent of the national manufacturing pay roll. According to the latest figures available for July, 1937, the average hourly rate paid to workers in all manufacturing industries was 65.7 cents, whereas the automobile industry was paying an average of 92.1 cents—just 20.6 per cent more than in July, 1936.

Shoe Industry Fears Czech Inroads

New England industrialists oppose the prospective reciprocity agreement with Czechoslovakia because they fear it would have a disastrous effect on one of their major industries, the shoe business. At Zlin, Czechoslovakia, is the greatest shoe factory in the world, with an output of 180,000 pairs every working day. The wizard who has made this achievement possible, Jan Bata, learned how to make shoes here in New England only twenty years ago. His labor costs are so low, and his factories so efficiently mechanized, that he is able to pay the high American duty of 20 per cent and still compete at a profit with American manufacturers of identical products.

Of course the provisions of the pact are not yet known, but the Bata Shoe Company is by far the most important private industry in Czechoslovakia, and New England does not see how shoes can be omitted from any agreement.

The field in which the foreign competition is particularly feared in New England is the cheaper grade women's shoes, and more especially the cemented shoe, shoes in which the outer sole is cemented to the lasted upper. New England worries because Bata can ship these shoes here, pay the duty, and make a profit.

Government Pump Priming

The flow of Government money into the business pump is being abruptly checked in the fall of 1937, and with the ceasing of Government priming has come a proportional check to the recovery of private business. That the government has been

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contributing an enormous amount of borrowed cash to the nation's purchasing power is illustrated by the following figures, which represent the net number of dollars:

1932	$1,646,000,000
1935	$3,154,000,000
1936	$4,025,000,000
1937	$972,000,000

When the pump priming started in an important way in 1932 the Government was striving to avoid priming the business pump. It sought above all else for a balanced budget, but deflation in business forced tax receipts to decline more rapidly than Government expenditures could be contracted, and the result was that the Government made a *net* contribution to purchasing power of more than a billion and one-half dollars in that year of acute depression.

It was not until 1933, however, that the Government actually accepted the theory of pump priming as a positive method of overcoming business depression. The theory was as follows: For the government to borrow newly created money or money not otherwise in use does not cut into the nation's total purchasing power. Passing this money over to people on relief or to wage earners or to farmers results in its quick spending and an immediate increase in purchases. These purchases increase demands on manufacturers and wholesalers for goods, and to satisfy this demand more income is distributed by industry to low-income groups who quickly spend this income. The combination then gives rise to profitable business operations, leading to expenditures on new plants. As recovery proceeds, rents rise and home building becomes economical. At this stage the pump is really primed and, with private sources borrowing and pouring out purchasing power, the Government can supposedly withdraw and start retiring by taxation the debt it is creating in generating the activity.

In three years of deliberate priming of the business pump as a means of recovery, the Government had dumped more than ten billions of dollars of borrowed cash into the pockets of its citizens for quick spending. This represented about one-half the total gain in national income. But soon after the start of 1937 a new trend dramatically appeared. Outpourings from the public Treasury continued to be large, but now the payroll tax, the surtax on undivided profits, and the curtailment of certain of the Government spending agencies began to draw dollars back into the Treasury, so that pump-priming rapidly dwindled almost to the vanishing point. Government stimulation of business has

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come practically to an end, and with that stoppage has come a reversal of the upward trend in business.

Less than a year ago the Government planners were able to say:

"The program has worked out surprisingly well to date. If it can be brought to a successful conclusion—and the prospect now appears reassuring—we will have acquired knowledge of a powerful weapon to combat the evils of economic instability in the future."

Now, however, the attitude is one of pessimism concerning the successful outcome of the experiment. The trouble is that the planners have been without authority over political pressures or over industrial and labor policy. They demonstrated their ability to generate economic activity but they also demonstrated their inability to overcome obstacles standing in the way of a shift from the shoulders of Government to the shoulders of private business. The trouble started when the payment of the bonus and the boom in the steel industry started an upturn in which prices kited and everyone had visions of getting rich quick. The higher prices met resistance from the consumers, whose dollars would no longer go so far, and the budding housing boom collapsed when the Government withdrew from the spending picture. Government spending had gotten recovery started in private business, but rising costs, over which the Government had no direct control, caused that recovery to run into trouble when the public spending slowed near to the vanishing point. Business leaders take a somewhat different view of the trouble. They claim that the Government, after spending vast sums of money, has imposed restrictions on finance and industry that stifle initiative and make it next to impossible for business to take over its normal function.

At the end of 1937, however, it is evident that pump-priming as a business aid has come to an end, and business is for the first time in more than six years standing on its own feet. Mr. Roosevelt appears to be finally sold on the idea that private capital from now on must take over the recovery load. The Government debt is too large to finance another large-scale pump-priming venture, and it may be expected that emphasis will be placed on ways to encourage business men and individuals to borrow and to spend money. This program, effectively carried out, would mean a balanced budget, no more harassment of utilities, new aids to railroads, and most important of all, encouragement of capital to enter the mortgage loan field.

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AUTOMOBILE INDUSTRY

If any industry is the keynote to industrial recovery it is the automobile industry, and if any industry has shown real indication of improvement it is that industry. Figures now available show that automobile production gained 27.5 per cent during the first six months of 1935 as compared with the corresponding months of 1934. Total units produced up to and including June 30, 1935, are 2,301,640. When we recall that there was a gain of 45.6 per cent in 1934 over the year 1933 and that 1933 was 38.7 per cent better than 1932, we realize that not only must confidence have been restored among automobile producers, but also that the nation must have tremendously regained its purchasing power. The total wholesale business for the year 1934 was $2,216,000,000, of which $1,453,000,000 went toward new cars and new trucks. Exports amounted to $231,000,000.

Corporation reports bear out the startling increase for 1935. The Chrysler Corporation which manufacturers Chryslers, Dodges, De Sotos, and Plymouths, reported in May a $2.12 a share quarterly earning on its stock. This is the largest first quarter earning in the history of the corporation, and is a tremendous increase over the $.76 earning for the same quarter in 1934. The net profit, $9,163,182, was nearly as great as the entire net profit of 1934. Automobile sales were 159,265, an increase of 51 per cent over the same period during the preceding year, according to the statement of Walter P. Chrysler. The Hudson Motor Car Company, fourth in the ranking of automobiles produced, announced first quarter net profits of $235,610, in contrast to a loss during the same period of 1934; and it is the largest profit for any quarter since 1931. In the second quarter of 1935, the Packard Motor Company, whose meteor-like return into prominence had startled automobile circles, shows a profit on its books for the second quarter of 1935 of $1,500,622. This is a striking contrast with the $1,711,123 loss for the same quarter in 1934. The Packard 120, now selling in the thousand dollar field has made a great hit, the company having produced 17,816 of them during the first five months they were put on the market. The Packard sales organization has been doubled to care for the greatly enlarged sales and six hundred new dealers have been added to the retail department.

General Motors, always highly successful because of its impregnable financial backing, reported $1.35 earnings per share of common stock for the half year ending June 30. This sum

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compares quite favorably with the $1.01 per share earning for the first half of 1934.

A further excellent indication of automobile business activity is noted in the increase in instalment buying as announced by the Commercial Investment Trust Company which finances purchases of Ford cars bought on the instalment plan. It reported earnings for the half year of $2.93 per share, with a net profit of $6,891,188, an extensive increase over the first six months in 1934.

Registrations

Registration figures for 1934 show great improvement over 1933. There were 530,528 Fords registered, 70.5 per cent more than the year previous. Buick showed a 44 per cent increase, Plymouth a 21.2 per cent increase. The total registrations for 1934 were 1,888,557, a 26.4 per cent increase over 1933. During the first four months of 1935, Chevrolet, Plymouth, and Ford registrations almost equalled the 1929 registrations for the same period. Yet the combined total of all other car registrations fell far below the 1929 height. Of these three, Plymouth's forge ahead was well-nigh sensational, and it established an all high record in February.

Recent trends indicate that the majority of the motor business has been done by General Motors, Ford, and Chrysler, while a large percentage of the other standard makes, which were controlled by "independent" concerns, have been unable to withstand the depression. Failures, losses, or bankruptcies have resulted in the cases of the Franklin, Flint, Chandler, Marmon, Willys-Knight, and Pierce-Arrow; and, although plans for reorganization have gone through for some, it is doubtful that they will ever regain their former prestige and status. The cause for such bankruptcies is twofold. Their makers have not had huge financial reserves to draw upon during the height of the depression while Ford and General Motors, with ample capital backings, not only withstood the depression with comparative ease but are even today planning large extensions. In the second place, the great majority of purchases since 1929 has been in the low price field. Thus it is that Chevrolets, Fords, and Plymouths have faired so well.

TEXTILE INDUSTRY

Of all the industries, perhaps the textile industry was most hit by the depression. The NRA had done wonders in raising the standards of the workers, giving them better hours and better

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pay. Yet although sweatshop competition was ended for a time along with child-labor competition, the troubles of the mills were not over. They had to charge higher prices in an already overloaded market; and when consumption fell they had to reduce their employees or fail. Figures for 1934 show that the consumption decrease over the preceding year for the four major textiles was 13 per cent, a terrific jump downward. The total consumption was 3,164,000 pounds, cotton declining 13 per cent from 1933, rayon 4 per cent, silk 2 per cent, wool 26 per cent. A further indication of consumption trends is noticed in rayon consumption. Americans had to substitute the use of this commodity in place of higher grade textiles to the extent that consumption was almost 200,000,000 pounds, the highest in American history, 1933 excepted. Silk consumption was the lowest in ten years, wool the lowest in over fifteen. Cotton, as usual, maintained its high place, 2,662,000,000 pounds being consumed.

The year 1935 hardly augured better. Cotton was the backbone of the industry but the Government's agricultural policies put the cotton textile manufacturers in a worse place than ever. The cotton loan policy and the curtailment of production had, in the first place, put an unnecessary premium on the commodity. That action was the least of the cotton manufacturer's worries. He was concerned with the processing tax of 4.2 cents per pound which to him seemed mighty exorbitant inasmuch as the cost of cotton was thereby increased 35 per cent. He had to pass that tax on to the consumer in the form of higher prices. Yet this was a costly procedure; since the higher he raised his prices, the less the consumer bought. The textile manufacturer tried to fight it out in the courts, but although a Boston court had held it unconstitutional, the Supreme Court has not yet decided the issue.

Back in March, the National Industrial Relations Board, taking alarm, had ordered a curtailment of production throughout the cotton textile industry. The textile manufacturer was then politely informed that he would be better off if he didn't do so much business. Yet he was supposed to keep all his workers. In New England, the condition became so critical that a delegation of the State governors in April entreated the President to take drastic measures to save the industry. They wanted an end to the severe processing tax, they wanted a change in foreign policy, particularly in respect to the importation of cheap Japanese goods. In answer to their demands President Roosevelt set up a

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committee. It was composed of four members of his Cabinet and was directed to make a careful survey of the cotton textile industry. It did, and the report that it finally made was in effect that the processing tax must stay.

The collapse of the NRA plunged the already badly stricken industry much deeper into uncertainty. The verdict of the court was an unwelcome bombshell to the workers. Many of them, who had for the first time seen decent hours and decent wages, under the NRA, had their wages decreased and their hours raised. The laborers complained and started to strike. It made no difference. Each manufacturer had to come down to meet the competition of his rivals.

Without an NRA, child labor and sweat shop competition was again becoming a threat to the industry. But an agreement was reached and signed July 29 by the Amalgamated Clothing Workers of America and the New York Clothing Manufacturers Exchange; and, by its terms, the worries of at least 80 per cent of the workers in the clothing industry were expected to be over. In accordance with the agreement, which, by the way, is to remain in effect until June, 1937, NRA hours and wages will be maintained. Further, no person under sixteen years of age may be employed by the members. Slack season work is to be equally distributed among all employees so that all wage earners in any one factory will be equally affected. One great worry of a large portion of the industry has thus already been cared for. The Supreme Court, in the Hoosac Mills Case, may soon give relief to the cotton manufacturers, although legislative efforts have practically put an end to any claims that manufacturers may have to processing taxes already collected. The real hope for the industry apparently lies in industrial recovery.

September showed vast improvement for textile manufacturers everywhere. This trend must have encouraged textile manufacturers to adhere to the old NRA standards in the matter of maximum hours and wage payments. According to the September 20th report of Goldthwaite H. Dorr, president of the Cotton Textile Institute, 97 per cent of the cotton textile industry, as measured by the active spindles in operation, has stood by the forty-hour maximum week and the wage requirements. Mr. Dorr's statement concluded: "The record established by the industry of nearly 1,200 units in the fifteen weeks since the Supreme Court's decision is one in which the industry takes justifiable pride, and one which must be reassuring to its employees, its customers, and the general public."

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BUILDING INDUSTRY

Although there was a marked increase in construction work during the first half of 1935, the published figures for 1934 construction gave a gloomy indication of business trends. Building construction is one of the important indices to recovery, for not only are lumber, cement, steel, etc., needed in quantity for such work but also thousands of workers are required. According to building permits issued in 354 principal cities, an expenditure of 364 million dollars was contemplated during the year. This figure is but 2.43 per cent above the preceding year and compares miserably with the $4,393,000,000 expenditure for these cities reached in 1925. The Department of Labor statistics for the same period, however, are a bit more encouraging. In the 819 cities surveyed (which have a population of 10,000 or over) the number of building permits issued was up to 351,221, an increase of 7.3 per cent over the preceding year, while the estimated cost was $492,630,536, an increase of 5.5 per cent over 1933. The Department deemed these figures encouraging, as this was the first year since 1925 in which there was an increase over the preceding year. A decrease of 12.7 per cent, however, was noted in expenditures for residential building, the total rise being chiefly accounted for because of alterations and repairs to existing structures.

The first set of statistics are derived from local building permits solely and do not include engineering projects or, as a rule public works construction. But they are a good indication of business activity. The huge Federal and state public works projects are merely temporary measures of relief and do not truly reflect business trends.

The first half of 1935 showed real indication of improvement. The value of construction work in June was 10 per cent above that of May. This is an important indicator of business trends, inasmuch as in the four preceding years a decrease of 20 per cent had been noted for this period. The increase for all construction was 87.4 per cent over that of the preceding June. The following table, which shows the per cent of change from June 1934 to June 1935, is taken from a report of the United States Bureau of Labor Statistics:

Type of Building	Number	Estimated Cost
New residential	+157.3	+228.9
New non-residential	+ 18.7	+ 74.8
Additions, alterations, repairs	+ 18.2	+ 21.3
Total	+ 26.5	+ 87.4

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As many as 7,231 permits were issued for new family dwellings. This is an increase of 204.7 per cent over June 1934. Average cost for one family dwellings for June was $4,244.

Prefabricated Houses

Makers of prefabricated houses have launched powerful drives for building homes in 1935. Instead of a nightmare of carpenters, bricklayers, painters, high cost, etc., the modern house builder need only arrange with Sears and Roebuck or a similar distributor to purchase his house. The price is certain and low, the assembling cost inexpensive and quick, and the result is a stronger-built home which has greater weather resistance and requires less upkeep than the conventional house. Prefabricated houses are, moreover, not limited to the low-price field. One can pay more for them than for an ordinary house, according to the buyer's taste and pocketbook. Low priced construction makes the greatest appeal, however, to a person who cannot afford a conventional house, but who may thus purchase an attractive house at comparatively little cost and put it up himself.

The essence of prefabrication lies in the standardized panel. This is built entirely by machinery within a factory, and thus building cost is lessened. But herein lies the great objection to prefabrication. The houses are built with vertical and horizontal lines, they have no sloping roof, they are not conventional. If the manufacturer can create a real demand for this new style architecture, he can revolutionize the building industry; for mass production will make his own prices much lower.

The prefabricated house may prove a great stimulus to the building industry, but, today, prefabrication is still in its infancy. People are usually willing to listen to new ideas, new developments, etc., but they are not eager to invest in homes that are such a radical departure from the customary and conventional. A prefabricated house does not offer the same allurement as the streamline automobile and similar modern devices. Yet as soon as individual prejudice is overcome, prefabrication has a great future. Not much more than a quarter of million new residential homes are built during normal conditions, however, so it is readily conceivable that a huge percentage of these must be prefabricated before more production in this line becomes a reality. The most we can expect from prefabrication is an awakened interest in new housing developments. This should stimulate increased buying with a resulting increase in production, particularly in the durable goods industry.

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THE NEW DEAL

Since the inauguration of President Roosevelt no slogan has been used more frequently by business men than "The New Deal." This phrase has been adopted in the last six months by writers, speakers, and wage earners. It is natural, therefore, that one should ask: What is "The New Deal"; in what will it consist?

There is little question that "The New Deal" will, first and foremost, have to do with the matter of employment. Millions of laborers are interested in knowing whether or not "The New Deal" will give them a security by which they may be reasonably certain of permanent employment. The thirteen million people unemployed in the United States for the past two or three years, in spite of their interest and efforts to find and hold a job, want to be sure that any new economic plan for the country will place emphasis on this phase of their problem. The employer, while interested in preventing a recurrence of unemployment on such a large scale in this country, looks more particularly to the security which will make possible the obtaining of reasonable profits in return for honest and conscientious effort on his part in conducting his business. Both employer and employee, therefore, as well as the public in general, looks to "The New Deal" chiefly for such security as will guarantee to them the continuance of a reasonable return for their effort.

Before discussing the meaning of this phrase so commonly bandied about by the public, it is necessary to look into what are now generally agreed to be the causes of our present difficulty. It is clear that we are still suffering from the results of the World War. The world could not waste human lives and capital resources as they were wasted by the conflict of 1914–1918 without disrupting the economic system on which we had been operating for decades. It is common knowledge that the extravagance which followed the war in this country and in the other countries is a contributing cause to the economic difficulties of the past few years. People adopted a scale of living from 1914 to 1929 far above that to which they had been accustomed. This could not be expected to continue. It is also clear that the war led to a renewal of nationalism more intense than any previous to 1914. This spirit caused the building up of tariff walls and of other commercial policies which tended to make each nation self-sufficient, and thereby destroyed the normal causes of international trade as it had existed in pre-war days. Along with the growth

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of this nationalism came the desire for military supremacy to some nations, and this has brought in its train a struggle for increased armaments with their resultant expenditures and animosities. Last, but not least, we must recognize as a cause of the depression of the past three years the fact that the average human being is dominated by greed. We have been suffering from an expression of this human greed during the years 1918 to 1929.

While many other causes have contributed to the depression through which we have just passed, it can scarcely be questioned that the specific causes mentioned above have thrown out of balance the economic system on which the world has formerly operated. Lack of balance rather than the breakdown of the system has been our difficulty. Men are thrown out of work and businesses find their market disappearing largely because a system gets out of joint. It seems to be clear that when economic relations have become as complicated as they have at the present time in highly industrialized countries, these relations must remain in reasonably perfect balance or our industrial machine will cease to function.

Is there work enough to go around? This question looms as one of the most vital and pressing of the time. Ever since the beginning of the industrial era, with its multiplication of steam power and machinery in production, every period of slackening trade has caused the laboring man to fear that he is being displaced by machinery, and that therefore there is not enough work to go around. There is no question that in times of depression such as we have just passed through, laboring men lose their jobs because the productive capacity of machinery has increased the supply of goods and at the same time has rendered the use of human hands less necessary. Unquestionably the NRA arrangements have proceeded on the principle that it is necessary to cut down the hours of laborers in order to leave work enough to be given to those who have been and are still unemployed. This is a necessary procedure in the crisis in which we found ourselves in the early part of 1933. It seems anomalous, however, that in the long run men should be prevented from raising as many crops as they can raise with reasonable effort, and of working a day of reasonable length. We have never found a satisfactory plan for destroying the results of human effort in field or factory. It may be and doubtless is a necessary procedure in a critical period, but in the long run the production of goods

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leads to the satisfaction of more demands and to the purchasing power necessary to buy the goods.

In what, then, does "The New Deal" consist? Surely the following seven points cover the main phases of this new policy. First and foremost we shall attempt a better distribution of the proceeds of industrial and commercial effort. It is generally agreed that there has been a tendency to limit the rewards of industry to too small a group of employers and investors. The new deal proposes to give the public in general a larger share in these rewards by a partnership between the government and business. It is repeatedly stated by those responsible for the new régime that the government does not propose to own or to manage business, but rather to work in partnership with it with a view to avoiding the recurrence of the economic difficulties through which we have just passed. A third aim in the effort is that of stabilizing the currency of the country, i.e., of stabilizing the purchasing power of the public. Surely in the past it has been evident that the purchasing power of a dollar has varied widely from time to time. This is evidenced by the changes in price level. Again the government makes clear that one of its aims in the future is to make competition reasonable and bring about an era of fair dealing. Surely the codes which have been arranged and are still being arranged for the principal industries give evidence of this desire on the part of the Administration. In the fifth place more publicity is to be given with reference to the reports of corporations, dealings in the stock market, and especially with reference to the conditions under which new securities are issued. In the sixth place the new deal will attempt to smooth out the curve of the business cycle. This it will aim to do by reducing the height to which the prosperity boom curve has carried us in times past and also the depth of the depression curve. It will be an effort to spread good times over a longer period by preventing outbursts of fanatical greed, thus leading to production beyond the bounds of reason. Lastly, it is clear that the President is attempting to increase the responsibility of the government itself and of employers in particular for the public welfare. This will mean better relations between capital and labor. It should result in giving a greater responsibility for public welfare to the laboring man also, and in stimulating an interest which both groups should have had in the welfare of their fellow men. Along with this joint interest in the public welfare there should be less deception in business, less manipula-

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tion of security prices, and more of the profits of industry should be given to consumers rather than to producers.

No way could be found to give a more definite idea of "The New Deal" than to quote the words of those responsible for it. The following passages are pertinent quotations from the words of those who are originators and promotors of "The New Deal."

Official Comments on The New Deal*

"With bewildering speed the events of recent months have been pushing the philosophy of economics and that of social relationships toward new paths, where the way ahead is difficult to see. Some things have been done simply to meet emergencies. But others have something of permanence in their purposes. Many men are of many minds. What some of those in responsible positions are thinking is best revealed by direct quotations. In presenting such quotations it has been the attempt to avoid spoiling the context through any significant omissions."

"The money changers have fled from their high seats in the temple of our civilization. We may now restore that temple to the ancient truths. The measure of the restoration lies in the extent to which we apply social values, more noble than mere monetary profit."

"The people of this country have been erroneously encouraged to believe that they could keep on increasing the output of farm and factory indefinitely, and that some magician would find ways and means for that increased output to be consumed with reasonable profit to the producer. . . . It is wholly wrong to call the measures that we have taken government control of farming, or government control of industry, or government control of transportation. It is rather a partnership between government and farming, and a partnership between government and industry, and a partnership between government and transportation, not partnership in profits, because the profits would still go to the citizens, but rather a partnership in planning and a partnership to see that the plans are carried out. . . . government ought to have the right, after surveying and planning for an industry, to prevent, with the assistance of the overwhelming majority of that industry, all unfair practice and to enforce that agreement by

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the authority of government. The so-called anti-trust laws were intended to prevent the creation of monopolies and to forbid unreasonable profits to those monopolies. That purpose of the anti-trust laws must be continued, but those laws were never intended to encourage the kind of unfair competition that results in long hours and starvation wages and overproduction. . . We are working toward a definite goal, a goal that is to prevent the return of conditions which come very close to destroying what you and I call modern civilization. The actual accomplishment of our purposes cannot be attained in a day. Our policies are wholly within the purposes for which our American constitutional government was established 150 years ago. . . The Administration has the definite objective of raising commodity prices to such an extent that those who have borrowed money will, on the average, be able to repay that money in the same kind of dollar which they borrowed. We do not seek to let them get such a cheap dollar that, in effect, they will be able to pay back a great deal less than they borrowed. In other words, we seek to correct a wrong and not to create another wrong in the opposite direction."

"Old fetishes of so-called international bankers are being replaced by efforts to plan national currencies with the objective of giving to those currencies a continuing purchasing power which does not greatly vary in terms of commodities and need of modern civilization. Let me be frank in saying that the United States seeks the kind of dollar which a generation hence will have the same purchasing power and debt-paying power as the dollar value we hope to attain in the near future."

"I have no faith in cure-alls, but I believe we can greatly influence economic forces. I have no sympathy with the professional economists who insist that things must run their course and that human agencies can have no influence on economic ills. One reason is that I happen to know that professional economists have changed their definition of economic laws every five or ten years for a very long time."

"Events have made it abundantly clear that the merchandising of securities is really traffic in the economic and social welfare of our people. Such traffic demands the utmost good faith and fair dealing on the part of those engaged in it. If the country is

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to flourish, capital must be invested in enterprise. But those who seek to draw upon other people's money must be wholly candid regarding the facts on which the investor's judgment is asked. To that end, this bill (Rayburn-Fletcher Securities Bill) requires the publicity necessary for sound investment. It is, of course, no insurance against errors of judgment. That is the function of no government. It does give assurance, however, that within the limits of its powers, the Federal Government will insist upon knowledge of the facts on which alone judgment can be based."

—Franklin D. Roosevelt, *President of the United States, as quoted on March 4, May 7, July 3, July 24, and May 27, respectively.*

"Revaluation of the dollar in terms of American commodities is an end from which the government and people of the United States cannot be diverted."

—*Official statement by the United States Delegation to the World Economic Conference, July 5.*

"In my opinion, the basic policy of this administration, as it is coming to be embodied in legislation and in administrative action, expresses a concept of the relation of worker to employer, debtor to creditor, state to people, which is quite unlike that of the past 12 years, at least. The expression of this new policy in governmental action was, in my opinion, destined to come because the fundamental policy of the past 12 years was destined to fail. The depression and the breakdown of business in the past months hastened the necessary expression of a new concept. Its formulation thus was born of necessity, but the principle back of it is very old. It perhaps can best be expressed in the word partnership, used by President Roosevelt recently. It conceives of the relationship of worker and employer, debtor and creditor, state and people as a common effort to unify the people of this country, regardless of economic group or geographical distinction, into a genuine nation of equals, conserving the values of our present economic order, but at the same time recognizing a common interest in national well-being and prosperity."

—Raymond Moley, *Assistant Secretary of State, May 21.*

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THE AUTOMOBILE INDUSTRY

The production of automobiles and trucks came to the forefront some years ago as the greatest industry in the United States. Early in the history of the industry—in 1908—the total production of cars and trucks in this country was 65,000; an industrial leader then predicted that the time would come when 500,000 motor cars and trucks would be manufactured and sold here every year. It was thought that the United States could absorb 5,000,000 cars before reaching the saturation point. How well this prophecy has been fulfilled is shown by the registration statistics of 1930 which record nearly 27,000,000 cars, buses, and trucks in the United States. By 1931 registration throughout the world had grown to 35,805,632 and in accordance with an estimate made by the National Automobile Chamber of Commerce in January, 1932, the number stood at 34,750,000. That the registration of January 1, 1933, will doubtless be lower needs no explanation.

The Development of the Industry

The magnitude of the automobile industry was not, and is not due solely to the plants which manufacture the cars. Scores of industries are engaged in the extraction of raw materials from the soil, in the fabrication of metals, woods, and textiles, in sales organizations and financing corporations—many such allied enterprises are dependent on the motor car for their existence.

But if we think in terms of the automobile plant only we see that few mechanical devices in the history of manufacturing have had so great and rapid development as the automobile. Many factors conspired to bring about a rapid expansion in this industry. The country possessed an abundance of the required natural resources, and inventive talent was at hand. The income of the American people both absolute and per capita has increased substantially in the twentieth century.

The automobile industry has grown beyond the wildest dreams of 1900 or 1914. It has had a more profound effect upon the business, social, and educational fabric of the United States than any other branch of industry or commerce. In spite of its phenomenal growth a survey for the years 1931 and 1932 shows features and tendencies, to a surprising extent, identical with those of 1914. In 1919 only 10.3 per cent of the cars manufactured were closed ones while in 1931 closed cars constituted 92.2 per cent of all those put on the market, but the industry has merely expanded rather than changed radically. Within the lifetime of

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men who pioneered in this field and are still active as heads of great corporations, the automotive industry has grown until its capitalization exceeded $4,000,000,000 and until recently it employed directly and indirectly over 4,000,000 people. For the consumer the automobile has come to be, if not a necessity at least an essential rather than an extravagance, as it was regarded in 1914. The following table gives production figures for passenger cars only in the United States.

PRODUCTION OF PASSENGER CARS FOR THE UNITED STATES ONLY, 1914–1931

YEAR	NUMBER PRODUCED
1914	543,679
1929	4,587,400
1931	1,973,090

The figures for 1929 and 1931 tell their own tale of the depression of recent years although the operation of motor cars and trucks indicates no such falling off in the last three years. Gasoline consumption rose steadily from 1931 when somewhat less than 2,000,000,000 gallons were consumed to nearly 14,000,000,000 at the end of 1929. While the rate of increase has not been as rapid during the last two years, nearly 16,000,000,000 gallons were consumed in the year 1931. If we think in terms of finance and include the sale of accessories, traveling expenses and incidentals, the automobile industry is unquestionably an outstanding one.

Nor need we speak in terms of finance only. Before the present depression affected all production unfavorably, the automobile industry brought direct benefits to approximately 5,000,000 wage earners, and brought indirect benefits of employment and wages to an additional group aggregating about one-tenth of our population. In more concrete terms we may show how widespread was the influence of the automotive industry in normal times by its purchases of materials for manufacturing cars.

PURCHASES OF AUTOMOBILE MANUFACTURERS IN NORMAL TIMES

10% of all cotton grown;
14% of all the tin produced;
13% of all finished rolled steel;
15% of the total output of copper;
17% of the aluminum;
18% of the hardwood lumber;
30% of all the nickel;
51% of all upholstery leather;
68% of all the polished plate glass; and
82% of the crude rubber;
not to mention
180,000,000 board feet of softwood lumber;
35,400,000 yards of upholstering cloth;
13,500,000 yards of top and side curtain material;
11,750,000 gallons of paints and lacquers;
44,800,000 pounds of hair and padding;
45,000,000 gallons of antifreeze solutions;
125,000,000 feet of brake lining; and
495,000,000 gallons of lubricating oils.

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In addition to this the railroads benefited from automobile manufacturers to the extent of 3,000,000 carloads of freight per annum in shipping the raw materials to the factories and the finished products to the consumers.

Lessons from the Automotive Industry

To describe the past development of the manufacturing of motor cars is to write history. Our primary purpose is, after all, to learn from the developments in successful businesses the principles which will help us in the future. What new features in the principles of business organization do we learn from the development of the automobile industry during the last twenty years?

The automotive industry was the first to apply strictly scientific methods to its entire operations, including not only factory operations but also accounting, salesmanship, advertising, personnel management, foreign exportation trade, and financing. This is the first helpful suggestion for many managers of small individual business concerns. The individual enterpriser has become afraid of the giant corporation lest it hamper his development and eventually crowd him out. If the big corporations use unfair methods then he may well complain of his sufferings at their hands. Unquestionably, some large corporations do have unethical practices; the best judgment, however, is that sharp practices and unfair methods are just as prevalent with the small firm as with the large one. Corporate practices are subjected to such merciless publicity that they dare not be too unethical. Suppose that the small business man, instead of criticizing the growth of huge corporations, should take a leaf out of their book of practice and adapt to his own business the same scientific methods which they have used so successfully.

Is the small corner grocery store having difficulties today because the chain store is unfair in its methods? Is the small tobacco store or bake shop being crushed out by the shrewd practices of the chain stores in their field? Doubtless they are not. To what extent today is the small corner store for groceries or drugs losing its former profitable trade because of the ease and cheapness with which their local consumers can reach the larger stocks and cheaper prices of a central city stock? The business tempo has changed in tune with the tempo of life as a whole in America. Business is faster, more scientific, less stable, more progressive. If the small business man can find and practice the principles and methods by which the greatest industry in America

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(the automotive industry) met these challenging conditions, he may find that he can perform a service quite outside the scope of the great corporation.

Consider the matter of planning for the future. The plant which puts out the Buick car can tell exactly what color and size of wheels will drop into position on a Thursday at 4.00 P. M. three months hence, to meet a certain chassis as an electric crane lowers it to a moving belt. What percentage of small business men ever make plans even for the Thursday of the coming week? Fifty years ago the small hardware store could ride along without initiative or plan, making a living from its customers. But times have changed. Running a business on momentum is out of date. The manufacturer of automobiles based his first hope of success on planning for the future, and making his future plans always an advance over the present.

How few small enterprisers have an adequate accounting system. Their control over outgo is practically nil because they have no knowledge of many dribbling expenses. How many individual enterprisers have an accounting system which will take care of depreciation or advertising or even their own wages of management? Here is the forte of the automobile industry; every item of outgo must appear in black and white. If the small business man had a similar accounting control he would be farther on the high road to profitable management.

Salesmanship is another key to the success of the automotive industry. Scientific salesmanship is not optional today, it is compulsory, because of changes in the buying public. The word "customers" used to mean "people who are accustomed to buy at a certain store"; today that word is less common in business. It has been replaced by "consumer." The consumer generally does not form the habit of buying at one place and of continuing to do so regardless of prices. The new tempo of life has broken down that habit. The consumer moves with ruthless regard for custom to the changing sources of satisfaction. Commodities no longer sell themselves; they must be sold. The automobile manufacturer became a scientific salesman; the small business man must do likewise.

What's Ahead for the Motors?

But if the making of cars and trucks became the largest enterprise in America and concerned directly and indirectly such a large group of our population, we are interested not only in the principles of its past success but in its future prospects.

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What are the prospects for the future, that is, after we return to normal thinking and normal production and consumption in this country. It is probable that we have not yet reached the saturation point for cars. It was long ago put at 5,000,000. We have operated nearly 30,000,000. Doubtless that is not a maximum number of cars and trucks for this country. Then too there is the foreign field. In 1931 there was in the United States one automobile for every 4.59 persons. Outside the United States the ratio stood at one car for every 200 persons. To attain throughout the world the degree of motorization existing in our own country would mean a registration of 436,000,000 cars. The attainment of any such figure is beyond the dreams of the most optimistic speculation, but it shows the possibility of sales for automobiles abroad even with keener foreign competition than at present.

A periodical cycle of three years seems evident if one studies the statistics of production in the automobile field since 1916. Figures show that production has proceeded in cycles characterized by remarkably regular periods of expansion followed by contraction before the general forward trend reappeared. This becomes evident from the following table:

Automobile Production, United States

1916	1,617,708	1924	3,605,206
1917	1,873,949	1925	4,265,830
1918	1,170,686	1926	4,301,134
1919	1,933,595	1927	3,401,326
1920	2,227,349	1928	4,358,759
1921	1,682,365	1929	5,358,420
1922	2,545,222	1930	3,355,986
1923	4,033,248	1931	2,472,359

Source: *The Index*, New York Trust Co.

The cyclical nature of production appears even more plainly if one consults the graph on the following page, for passenger car production in the United States.

What's ahead for the motors is of interest not only to the automobile manufacturer but to many other industries as well, as becomes clear to one who sees the importance of car manufacturers' purchases of materials in the table above. For some years before 1929 new car purchases tended to stabilize around 1,000,000 cars a year; replacements seemed to seek a level at about 2,300,000 per annum.

There are certain unfavorable factors affecting the recovery of the market for automobiles at home—decreased purchasing power through the fall of prices for commodities and through

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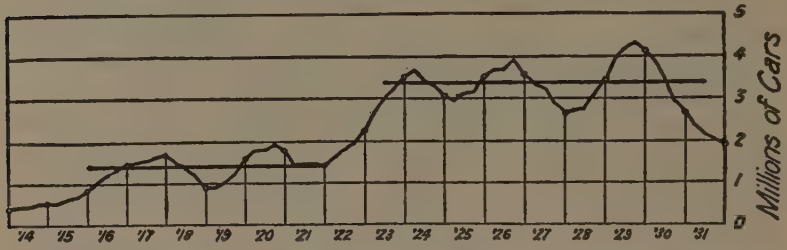
Passenger Car Production in the United States



Domestic passenger-car production tends to oscillate about a horizontal line (no growth). Before the advent of self-starters, four-wheel brakes and inexpensive closed cars, before the day of women drivers, this level was about 1,400,000 cars annually; afterwards it rose to an "average" level of 3,300,000 cars annually. These levels were made by combined new car buyers and replacement, which also tend to stabilize at definite levels. Current production is below even replacement needs.

Source: *Barron's*, May 9, 1932.

lower wages, increased taxation especially on motor cars and their operation; abroad the same unfavorable factors operate, and in addition sales abroad will be hampered by tariff and growing nationalism. On the other hand powerful factors are at hand leading to a renewed effective demand for more cars. Replacements have been abnormally low for more than two years past. From five to six million cars must now be "on their last legs." New roads are being built, even more than in times of prosperity, to help the unemployment situation. Waste has been eliminated in automobile construction so that better cars can be built for lower prices than before 1929. The demand for American cars abroad is bound to increase in spite of tariffs and a nationalistic spirit. The future of automobile production in the United States looks bright; it will have a big part in restoring prosperity to many other enterprises in our country.

Despite the discouraging outlook of 1932 there is every prospect that the automobile industry will again be in a thriving condition because the standard of living in this country now demands the extensive use of private cars. Homes have been purchased in the suburbs with automobile transportation definitely in mind. To give up the motor car would mean selling the suburban home and buying, or rather renting, another one in the heart of the city. The American public would regard such a move as a step backward, and hence unlikely to be taken. The automobile is a fixture in American life. Our effort now is to increase the purchasing power of the public by employment.

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PRODUCTION

Introduction

THE factors upon which production depends are: (*a*) The plant, including equipment; (*b*) the personnel; (*c*) materials; (*d*) processes of manufacture; (*e*) distribution of product.

Under the heading of *the plant* are to be considered the reasons for locating it in some given part of the world; then its location within that district; the actual site chosen; the type of buildings best adapted to the work to be done; the machinery necessary, including the power plant, handling devices, whether traveling cranes or conveyers or simple chutes; and all the things necessary up to the time that the employes report for work.

Under *personnel* are included all the problems of providing a flow of labor toward the plant without undue disturbance of the labor market for other employers, the training of employes and the handling of them so that the outward flow is only sufficient to prevent stagnation in the force. In connection with personnel, also, must be considered the methods of payment for labor and their general relations to the community, as well as the subjects of housing, transportation, feeding, health, exercise and recreation.

The subject of *materials* relates to the purchase or control of raw materials, fuel supplies, etc., as well as the problem of getting them to the plant and ready for manufacturing processes.

Under *processes of manufacture* are included the varied methods of doing the required work on the materials and the assembly of the finished product, if it is such a product. In this connection must be considered the necessary special tools, jigs, and fixtures for expediting the work, that may not have been included under plant.

The subject, *distribution of product,* deals with the distributing or shipping of the product to customers or agents. This work is on the border line between production and sales and may be handled by either the works manager or the sales manager.

Since production requires attention to all these things, some form of organization is necessary to carry on the business; this organization may be a one-man affair, or line and staff, or

it may take in everybody in the plant under some form of employe representation.

THE PLANT

Location

Lessons From Old Plants.—Many prosperous plants are seemingly located without reference to any business principles. It will usually be found that such plants have begun in a very small way. Often two men, sometimes only one, have thrown up their jobs and begun together in a little shop handy to their homes. The business has developed slowly, but they have put into it every bit of profit above the barest living expenses for themselves. They have had to have larger and larger quarters, but have always been cramped for money. Consequently, they have built on additions of the cheapest type they could, which resulted in the rambling shop that is so hard to organize effectively. Study of these plants shows things that should be avoided in a new plant, but is not especially helpful so far as planning new buildings for another firm is concerned; for the location was determined by the necessities of the founders.

The man who is fortunate enough to have the opportunity to plan a new shop without the limitations that surrounded the founders of the business is fortunate. If he has the problem of planning a shop to house an entirely new industry which has no traditions, he has an interesting engineering problem, but one which from its very untriedness is full of risks to his reputation and to the stockholders' pocketbooks.

Position on the Line From Material to Customer.—The first consideration should be to locate the plant somewhere in the straight line connecting the source of materials and the customer. The expression, *straight line*, as here used, does not necessarily refer to a physical straight line, but it means the most direct and feasible route, taking into account the fact that water freights are normally lower than rail, and that established routes of trade are more certain than those which may be more direct in point of miles.

The time element is often of more consequence than actual miles, though in the case of most manufactured goods the matter of perishability is not a factor. In the canning industry, however, it is, and the vegetables, fish, meat, or whatever is to be canned, are put in the tins at a point as near as possible to where they are raised or caught. The tins themselves need not necessarily be made at that point; in fact, they hardly can be,

for one can factory has the capacity to supply many widely distributed canneries. The cans should therefore be made on the line between the sources of sheet tin and the best distributing point for the various canneries.

If the raw material is heavy or bulky, there is need that the plant be near the source of supply, especially if distribution is wide and the finished product is more compact or lighter than the material. Such is the case, for example, with a certain type of aeronautical engine in which the block of cylinders is machined from a casting that weighs ten times as much as the finished product. A similar condition exists with an ore like bauxite, from which aluminum is made, which must be reduced to metal where electric power is cheap. The ore as mined carries large quantities of water, which must be calcined out; therefore, since it costs just as much for freight on a ton of water as on a ton of bauxite, it is natural that this first step of the manufacturing process should be carried on at the mines. The same is true of many other products; thus copper smelters are at the mines. However, with large capital and water transportation, and the very best means for handling, it is possible to transport iron ore profitably to the steel mills nearer the user.

Often, because of certain conditions, it may not be advisable to locate the plant on the direct line between the materials and the customer, but the matter should always be taken into consideration when making a first location.

Labor Supply

The question of a supply of labor should be taken into account in deciding on the location. A plant that is to employ only unskilled or semi-skilled labor can afford to pass by this problem, provided the business is large enough to justify building a town of its own. The few skilled men and the executives that are always necessary will go to such a town only reluctantly and under the persuasion of high salaries; but the number of these as compared with the great number of laborers may be so small as to be of comparatively little importance. If, on the other hand, the work is such that many skilled men must be employed, it is better to go far enough from the straight line between material and customer to get a ready flow of the desired type of workers. If women are to be employed, it is necessary that the plant be fairly near to large centers of population, though there is an exception in the case of mills that employ entire families in which every one over the legal age works in the mill. Such families will go anywhere that money

is offered. There is, however, a gradually increasing tendency for even the lower grades of labor to inquire into the living conditions, and particularly the schools, of the new community.

Assembling Various Materials

Many manufactured products are made of more than one material. The automobile is an example. Hardly any automobile factory makes its own cranks, or cam-shafts. Each shop may grind them, but the forgings are the raw material in such case. These forgings may not be made on the straight line between their raw material and the automobile factories; in fact, a great many of them are not. Also, automobiles must have tires, and the tires are made in still other factories, which come nearer to being on the line between their raw material and their market than do the crank-shafts. Automobiles also must have aluminum castings, which are made from an aluminum alloy. The original raw material of aluminum is a hard clay known as bauxite, which comes from France, Arkansas, or South America. The reduction of the ore necessitates the intense heat of the electric arc, which is most cheaply obtained by water-power. Therefore, unless a manufacturer owns his own water-power he is attracted to the immediate vicinity of Niagara Falls, and there he is handicapped by heavy freight rates from his nearest supply of raw materials.

For the foregoing and many similar reasons the automobile manufacturer cannot get very near to the straight line between his raw material and his customer. This, however, is of comparatively little importance, for his greatest problem is to secure a large supply of labor suited to his needs. Such help is located in the large industrial centers and it is difficult to induce it to move; so, regardless of whether these large cities are in the ideal position or not, the automobile manufacturer is almost compelled to accept the location that has been selected by others, and he finally locates his shop in Detroit, Cleveland, or some other large city where many mechanics are employed. He does this because he knows that mechanics congregate where work is known to be plentiful, and also that they readily move from shop to shop. This latter fact is an advantage to him in the beginning, but later is a disadvantage, since it causes a large labor turnover.

City Versus Country Locations

Many manufacturing plants of large size are in the business centers of large cities, where they can grow only by erect-

ing higher buildings. They began probably with much more room than any one dreamed they would need, but when they reached their boundaries the plant was much too expensive to move, and yet was worth what it cost only if the concern kept going. However, in many cases there are great advantages in being centrally located, and these advantages, especially ease of hiring help, may overbalance the high cost of plant and the difficulty of access to materials. Very few of these centrally located plants have adequate railroad facilities for heavy work or for handling either raw materials or product in carload lots. If, however, the work is light, such as the manufacture of paper goods, boxes, valentines, etc., it may be profitable to have the shop near to its employes and pay more for handling the supplies and shipping the product; in general this is true wherever women are employed, except, possibly, in the mills where whole families are taken on at a time.

Shops having seasonal work that can be done in the winter can profitably locate in the country where they can draw the farmers who would otherwise be idle all winter or else go to town for jobs.

All the signs point toward the necessity of placing shops on the outskirts of large cities, except in cases where other considerations than obtaining help have to control. This is because desirable laborers will not go far from the excitement and interest of city life. They are willing to live outside up to about an hour's travel from work. The shop can be located about a half-hour's ride from the center of the city and the other half hour be allowed for distribution of help to their homes; or the shop can be located an hour's ride out and be surrounded by the homes of the employes. However, in this latter case, the fare for the hour's ride must be very low.

Rural Industries

Certain industries that can be curbed in their growth and that employ women largely, thrive in the country; as, for example, the manufacture of straw and felt hats, underwear, neckties, etc., and some of the minor textiles, such as hosiery. These businesses do well until the point is reached where they need the services of more girls than are available in the immediate vicinity and they have to reach out and induce others to come into the town to fill the shops. Any legitimate means of aiding the healthy growth of the community are helpful, but bringing in individuals with no family ties is conducive to poor

relations with labor and is very apt to raise the rate of wages, which must necessarily be paid to all alike.

Locations Determined by Power Supply

Many industries are dependent on low-cost power. The aluminum industry has already been mentioned, but the textile industries are equally needful of steady, dependable power at low cost.

The cheapest power is that of water when conditions are favorable. To be sure, wherever there is water-power for sale in small quantities, as when distributed by power companies like those at Niagara, there is not much difference between the price charged and that charged for power derived from coal, for in such case the difference goes into the profit of the power company. But, if the pond and dam are owned by the factory, the actual cost is very little more than that due to depreciation and interest on the cost of the equipment and dam.

The desirability of steam power is dependent on the ease with which coal may be obtained. The numerous troubles in the coal fields, and the uncertainty as to whether coal can be assured at the factory at any price, make water-power attractive. Because of the ease with which power may now be transmitted for considerable distances by transforming it into electricity and back again at the distant end of the transmission line, the worth of a water privilege is now greater than ever. If, however, the first cost of a water privilege is too high, it is entirely possible that steam may be the cheaper.

Steam is also made by burning crude oil instead of coal. The uncertainty in regard to prices of fuel oil and some of the sources of supply give an element of risk to installations for oil burning. Fortunately, most installations of this kind can be made so that, without radical changes in the boiler setting, they can be changed to burn coal in a few days at the outside.

Importance of Transportation Facilities

If the manufacture of watches is contemplated, consideration of transportation facilities for either materials or product is hardly necessary. A freight car that might bring a hundred dollars worth of iron ore to a blast furnace would take away millions of dollars worth of watches.

If, however, the transportation problem is a large factor in the business, as in the case of blast furnaces, machinery, textiles, shoes, etc., then a location on a branch of a large railroad system or where water freight is available, is imperative.

It is not so much the size of the line that runs past the doors that counts, as it is the facilities for getting goods through to the purchaser or of receiving materials direct. There is also an advantage in being near a junction point where there is a choice among a number of roads; not that any competition can be aroused between them as to rates, but because much better service is assured. More than that, in times of embargoes due to labor disturbances, or tie-ups due to storms or any other cause, it is usually possible to get goods in and out by some route.

Water rates are normally much less than rail, and have a distinct advantage where time is not an important element. If the business is largely export, proximity to a port that handles shipping to all parts of the world is a great advantage. The effect of such conditions is seen in and around New York City, where a great many manufacturing concerns have come, attracted by the convenience for shipment to any part of the world, and also by the ease of receiving shipments of materials from every source; for here transportation to and from all parts of the world can always be obtained. It does not follow, however, that all exporting should be done from the port of New York. From the point of view of the country as a whole, it is likely that it would be better if all the good harbors along the Atlantic coast had a share of the trade proportionate to their ability to handle it.

Dependent Industries

Certain shops are limited in their range by the necessity of being near certain other shops. Rolling-mill machinery is usually built near rolling mills, though a notable exception occurs in New England. In other cases there is no apparent reason for proximity. For example, Ford accessories are sold wherever the cars go; there is no need that they be manufactured in Detroit, yet it is natural that they should be. Coopers and others can often profit by putting their little shops next door to a large one that uses their product.

Proximity to Local Markets

Certain manufacturers of perishable goods, as well as restaurants, hotels, bake shops, and to some extent candy shops, are influenced in their location by the question of proximity to their respective customers. It is not enough for them to locate in a prosperous city; they need to be on the street corner where foot travel is the most dense, and on the ground floor, so that

their customers will not have to go up steps to get to them. Of course this can be attained in a candy shop, or a bake shop by having the factory elsewhere and the store located in this very desirable place. Hotels and restaurants, buying flour, vegetables, meat, etc., are in a position to profit by railroad connection; but it is very seldom that good facilities of that kind can be had where the greatest crowds pass, so this factor is almost always sacrificed to the more important one of securing customers.

Local Inducements

Many cities, observing that growth comes with manufacturing, offer inducement for new business. These inducements may be in the way of stock subscriptions, remission of taxes for a time, or they may be the more legitimate ones of low permanent tax rate, good streets, water, fire, and sewerage departments, good schools, and housing.

Offers of financial assistance should be carefully scrutinized, as there is too often a string attached in the form of added paid officials who may be found to be hangers-on of some town official; or it may be that it is expected that the taxes remitted the first few years will be more than made up in after years by excessive valuation, on account of similar remissions made to other new comers. It should always be borne in mind that every new business coming to a small city or town induces more jealousies than it would in a large place where it might grow unnoticed. The very people who are most anxious to see the town grow are sometimes the first to criticize the new firm for taking the workmen who "belong" to a concern already there.

Often the reason why the town can make great concessions is found to be the possession of a shop building which the people of the town had built for another concern that failed. This building is offered for rent at a figure that will bring back all the money actually subscribed in a very short time. This is a legitimate thing to accept, if the building is adapted to the purpose in view; but if any extensive changes are needed, or any changes that will not be made by the owners, it is a wise thing to weigh very carefully the advantages and disadvantages beforehand. Again, almost any town giving financial assistance will expect to have a representative on the board of directors; and while that seems a very reasonable and moderate request, it is the same thing in many cases as opening the books and all the hopes and ambitions of the company to the entire public.

Small Beginnings

It will be wise for a small concern that has hopes of becoming a large one to exist in hired quarters as long as possible without having to make a lease of prohibitive length. There are, of course, very decided objections to using other peoples' buildings; for alterations of any moment have to be a matter of agreement with the owners or else be lost completely when the premises are evacuated. However, in the course of the growth of any industry, there usually arrives a time that is very critical, a time when the owners can see nothing but success ahead, but when banks and financiers do not share their hopes. That is the time when the need of enlargement is most apparent to the owners of the business and when it is the hardest to accomplish. Then, if the capital of the company has been kept for machinery and working purposes and is not tied up in buildings, there is a great deal more chance of getting assistance from a distance when the local banks will not help at all. There are always opportunities to use money in any growing business, and care should be taken not to tie up too much in land for further expansion, but which may not produce any returns for years to come, or in owning mines or mineral deposits to make sure of future materials. All these factors should receive careful consideration and whatever money may be available should be used in such a manner that it will bring the greatest returns in the long run.

Buildings

The object of the buildings is to provide a shelter for machinery, equipment, materials in process, men, and finished product. It is necessary that the building shall furnish a suitable foundation for all the equipment, that it shall be convenient for the processes of manufacture, and that it shall be well ventilated, dry, or as dry as the processes demand, and light, if the processes allow it. Any money spent for things in excess of these demands is put into the building for purposes of appearance, or because the bank that holds the mortgage insists on a fine well built building or for some reason apart from production.

Permanence

Building for all time would seem more sensible if it were not for the sorrow with which we contemplate a shop doing business in a building built for all time, even only thirty or forty years ago. And we cannot be certain that our own look into the future will be any better than was that of the people

who built a short time ago. So many things change, and engineering is going ahead faster now than ever before, that we really can have less confidence than our fathers had as to the future.

Types and Methods of Construction

For factory purposes, three distinct types of buildings are in use. These are: The single-story building with *saw-tooth roof*, Fig. 1; the *open shed*, with a traveling crane and possibly a gallery on one or both sides, Fig. 2; and the *loft* building, Fig. 3. Each of these types of building has a distinct use, though the work done in a loft building can usually be done in any other type, while that done in either one of the other two types very often could not be done in the others. Hybrids of these types occur, as for example, that shown in Fig. 4, where the lower story of a loft building is made high enough to permit the use of a traveling crane which would ordinarily be installed in the shed; or a monitor section, as in Fig. 5, may be put in between saw-tooth roofs; or a saw-tooth roof may be placed on top of a loft building or on top of the galleries of a shed-type building.

FIG. 1

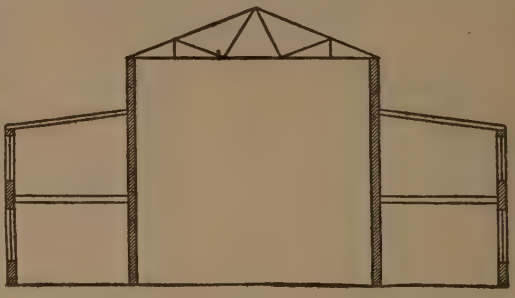

FIG. 2

The Saw-Tooth-Roof Building

The saw-tooth-roof building is adapted only to places where land is available and not so expensive as to make it desirable that area shall be gained by erecting high buildings. It affords as good a foundation for heavy machinery as can be had anywhere; that is, as good as the land on which it is built affords. It is easily heated, and has another advantage in that it is easily supervised, provided the management does not allow many tool rooms and other partitions to be put in so as to cut the space

up into small rooms. It is harder on the superintendent and others who must cover the area, as the distances to be traveled are considerably greater than in the case of the loft building.

The saw-tooth-roof shop, all on one floor, gives the most ideal lighting that can be had. It is easily adapted to northern

Fig. 3

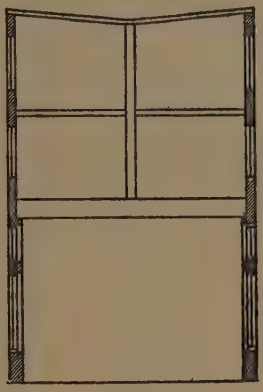

Fig. 4

climates by making the lower point of the saw-tooth a large sloping gutter, as shown in Fig. 6, so that there is no danger that water from thawing snow will back up over the level of the bottom of the sloping sash.

The Shed Type

The shed gives the largest space with clear room free from posts. Its floor area can be most efficiently used, as very little

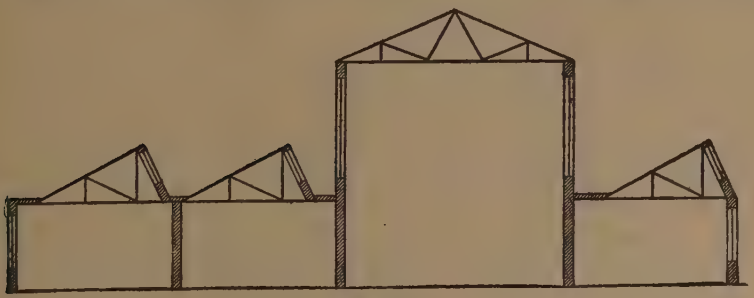

Fig. 5

space for passages need be left for trucking; for most large work is carried overhead by means of traveling cranes. Cranes really increase the effective floor space, even as much as 20 per cent.

in some cases. However, they do this at the expense of a costly crane that is not always used with good judgment. It is nothing unusual to see several men stand still and watch a 20-ton crane pick up a 50-pound box and carry it up the floor. This is not so inefficient as it may seem; for, if the floor is used to advantage and no space left for trucks, then it may be that this is the only way that the job could be done. The error, if any, was in making necessary the removal of a small box from such a floor at all.

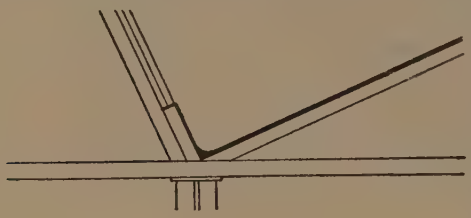

FIG. 6

The shed type of building is not easy to heat, as the warm air has a tendency to rise to the peak of the room and leave the workmen cold.

The Loft Type

The loft building is the result of high land values, and is made profitable by the use of elevators. The shortness of the distance from one part of such a building to another is a great advantage in light manufacturing that cannot follow a straight line. For example, as shown in Fig. 3, in the loft building the distance from the center of one floor area to that of the next is only the height of one story, while if the floors were laid side by side on one level, the distance would be the entire width of the building. The loft form of construction therefore saves a great deal of movement of goods in process of manufacture; and as movements by elevator are much more quickly made than are the longer horizontal ones, a considerable saving results if a a good freight-elevator service is installed. The loft building is, however, limited as a foundation for machinery. Usually, city ordinances call for a strength of floor to carry about 250 pounds per square foot. This weight includes the machines, the material in process, men working on it, and any emergency load that may be required from time to time. Sometimes the actual strength is made sufficient to carry up to 300 pounds per square foot; but this involves a very heavy building, with many posts that obstruct movement and always seem to come just where a machine or a shaft or a belt should come. The posts on the ground floor take up a great deal of space and obstruct the light just where it can least be spared, as they must be large enough to carry all the floors above them.

Usually, the roof over a loft building is nearly flat. In the city, it is made with a pitch toward the center, as shown in Figs. 3 and 4, where pipes carry the water to the sewer; in the country, the pitch is usually toward the walls. The roof is usually covered with tarred felt and gravel in a manner that has become standard.

The loft building is the most easily heated of any; for the separate floors can be heated independently, as very little circulation of air takes place through stair wells or elevator shafts.

Both the shed and the saw-tooth-roof buildings can be built in a more temporary way than can the loft building. The latter requires heavy posts or bearing walls, as those below have to carry everything above. This strength of walls and posts is the principal reason that the cost per square foot of floor space or per cubic foot of capacity is greater in a loft building than in buildings of the other types. This extra construction cost is partly offset by the fact that a roof the size of one of the floors covers all of them in a loft building, and the area of the foundation is the same regardless of the number of floors. The cost of the foundation increases comparatively little with the number of stories, unless the building is situated where piles have to be driven or where a deeper excavation is necessary for a heavy building than for a light one. The latter condition would exist where a stratum of good gravel is sufficiently firm to carry a single-floor building, but is underlaid by a layer of peat, loam, or other soft material, that would make the erection of a tall building unsafe unless piles were driven or the foundation carried down through the soft material to some solid stratum below.

Buildings as Foundation for Machinery

Some manufacturing requires such light equipment and so little of it that any building that will hold the employes and the materials in process, and keep out wind and rain is sufficient. On the other hand there are lines of manufacturing in which very slight vibration of the building is detrimental to good work of the machines. For example, precision machinery requires a building as near vibration-proof as possible. This quality is not synonymous with strength, for a steel-frame building may have an excess of strength and yet sway appreciably in a wind. A brick, concrete, or stone building will be less apt to show vibration than one with a steel frame. Reinforced concrete seems to be the ideal structural material for loft buildings, because the mass of the building absorbs the vibrations set up by the operation of machinery. It is also possible to make the

building as strong as may be desired or to make one portion of it extremely heavy and another part light. However, concrete is not so well adapted to very light construction, and consequently is expensive for the lighter forms of manufacturing buildings. A concrete building, however, is very effective in appearance if built with panels, the interior of each of which is glass with the exception of a thin wall of brick about 3 feet in height at each floor. Such a building can also be made with steel center posts and floor girders and a wooden floor, thus making a light building that has much of the advantage of a concrete building and is less expensive than the lightest all-concrete structure that would be practicable.

Floors

The objections most often raised to concrete floors is that they are cold, that is, that they abstract heat from the men's feet; also, that they are hard and unyielding and tire men more than do the more resilient wooden floors. Just what part of these objections is due to psychological reasons and what part is fact, depends on the men to a great extent. Men accustomed to walking in plowed fields and dirt roads find themselves very tired the first few days they travel on city sidewalks. Also, men who have always been accustomed to walk on brick or granolithic sidewalks find themselves extremely tired at night if they attempt to do as much walking in the country as they do regularly in the city. This is partly because of a difference in the muscles brought into play. The trouble about the cold is undoubteldy real in the cases of people with rather sluggish circulation of the blood, and especially if their work is largely brain work, which causes the blood to flow to the head rather than the feet.

The real test of concrete floors, however, comes not in the number of opinions of prejudiced persons, but in a comparison of the actual labor turnover in plants having concrete floors as against similar plants having wooden floors. This has been tried out, and so far no added labor turnover has been reported on account of concrete floors. In fact, the labor turnover in certain instances that have come under the writer's observation has been less on concrete than on wood. This may be, however, because the concrete buildings, being modern, were so much better lighted, the elevator service was so much better, and in all ways they were so much more desirable to work in, that their general advantages more than offset any objections as to the floors.

Wooden floors for loft buildings are very acceptable for

moderate loads. They are usually of the so-called *slow-burning* construction with heavy hard-pine timbers, supported on wooden posts of substantial size. The timbers are spaced, usually about 8 feet center to center, and on them are laid 3-inch or 4-inch hard-pine planks with tongue and groove or spline between them, and over the plank a layer of 1-inch flooring, usually maple. Such a floor is resilient and is safe for loads up to 150 or even 200 pounds per square foot. A still stronger floor is made by using 2-inch planks of any desired width laid on edge and each spiked securely to the next.

The top flooring, or wearing floor, may be either square-edged or matched, according to the expected wear or the need for an especially smooth floor. The matched flooring will give much the smoother surface at the beginning; but if there is much wear it is more expensive to cut out a section and relay it than if it were of square-edged stock. The square-edged flooring costs less, as the waste due to the tongue and groove is eliminated and usually a poorer grade of lumber is used. The labor also is less, as the square-edged flooring can be laid without the trouble of driving up each joint.

In one-story buildings, concrete floors are very commonly used; though a wooden floor made by bedding hemlock plank in a tar-and-gravel mixture, with the usual maple flooring laid over the plank, will carry very heavy loads, and appears to last almost indefinitely if not subject to floods from time to time. However, at the usual price of lumber it is doubtful whether such a floor costs any less than concrete. When machinery that is too heavy for the floor is to be installed in a one-story building, the ground is excavated at the proper places and concrete foundations of the necessary weight are made.

In galleries beside a crane way, floors similar to those described for loft buildings are used, except that, as such floors are almost always used for very light work, they may not be so heavy. The steel-frame construction is cheapest for buildings having a wide span, such as is required by a crane way; therefore, it is customary to carry the steel-frame idea through the side bays, and the wooden floors of the side galleries are usually supported by steel girders or **I** beams.

Fire Risks

In designing any industrial building, the risk of damage by fire should be carefully considered. There are three types of construction, as follows: One, the *slow-burning;* another, the *fireproof;* and the third, the *partly non-inflammable.*

The slow-burning construction has an outer wall of brick, stone, or concrete, with large window spaces, which may be filled with windows in wooden frames. Wooden floors are laid, as already described, on heavy hard-pine timbers, widely spaced so that there will be no pockets into which it is impossible to throw water in case of fire. The whole construction is inflammable, but the area exposed to the air is so small compared with the bulk of the timbers, that burning proceeds very slowly after a protective coating of charcoal is formed. Such buildings look very bad after a fire; but they usually stand, unless the weight of water held on the floors and added to the load already there is so great as to break them down.

Fireproof construction is made up of reinforced concrete, or of steel fully covered with concrete so that none of the metal that might be exposed to the heat of the fire is carrying any weight. Such a building usually has steel window frames, with wired glass on the sides near to other buildings. It can burn only as the contents catch fire; and it requires a long fire and extreme heat to affect the girders unless the concrete covering spalls off the girders which it should protect.

The partly non-inflammable construction, which is the unprotected steel-frame construction, is very largely used. In case of fire, the steel columns, girders, and trusses assume the most weird and fantastic shapes, the whole thing comes down, and it is an almost total loss, as the cost of cutting up the mass, even with the oxyacetylene torch, is equal to the scrap-iron value. However, this construction is likely to prevail until some practical method of fireproofing trusses is discovered. Such trusses are a necessity over crane runs, and it is necessary that the crane ways be supported on suitable columns. A compromise is often effected by using reinforced-concrete columns for the crane ways or else having the steel columns liberally encased in concrete; but the roof trusses are still left open to fire.

How much money should be invested in buildings and how much spent for fire protection and how much for insurance are matters for individual study in each case. If the enterprise is untried, if it is something in which a large present profit is expected and the future is problematic, then a high insurance rate is not necessarily an evidence of poor planning. Only the most stable and settled industries can truly afford the fully fireproof type of building.

Sprinkler Systems

An expedient for reducing the fire risk without adding greatly to the cost, is the use of automatic sprinklers. These

deluge the seat of fire with water, and in by far the larger number of cases cut down the fire damage to almost nothing. The water loss is much more likely to be the larger. The expense of installing a complete sprinkler system is much less than the additional cost of building a fireproof plant. The saving in insurance alone will usually justify its installation, and the added security will pay good dividends.

Relative Production in Different Types of Buildings

Certain types of buildings are best suited to certain classes of work. The loft building is adapted to miscellaneous business in which the flow of work is more or less crisscross; that is, work where, though the principal part of the material follows a consistent line from raw material to finished product, many collateral parts have to cross and recross this line. For example, the heaviest casting of an engine lathe may go first to the planers, then to a drill, then to a horizontal boring machine, and then to the erecting floor. There will, however, be other parts, as for example the headstock, which will go to the milling machine, to a drill, to a planer, back to a drill, then to a planer, and finally to the erecting floor. If the shop is a large one, each department may build a portion of the machine and have all the machinery in a straight line to do each job; but ordinarily it is found advantageous in such shops to put all the planers in one group and all of each of the other tools in similar groups, in order to permit of giving each group the expert supervision that brings out the best work. With the last-mentioned arrangement, a certain amount of crossing of lines of flow of work is inevitable, and the loft building is probably best adapted for such conditions; because the total distance to be traveled from any one part to any other part of the building is the minimum, as the elevators make possible a short run from the center of one floor to the center of another.

The saw-tooth-roof shop should ultimately assume, as nearly as practicable, the form of a square, so that the shortest lines of travel may be maintained, not only for the flow of material but of travel for supervision.

The shed type of building with traveling crane is apt to stretch out to a great length, with sometimes three or four cranes on the single long runway. This form is advantageous for the handling of material in shops where everything can travel one way; but the work is hard to supervise, as the lines of travel for every one and everything are up and down the length of the shop.

HEATING AND VENTILATING

Methods of Heating

One of the functions of any industrial building is the protection of the workmen and the materials in process from the weather. The great bulk of all manufacturing, the world over, is done where artificial heat is necessary for a considerable part of the year. Consequently the method of heating is of importance, if for no other reason than that employes look out for themselves so far as possible and try to get into the most comfortable quarters they can for the winter.

The forms of heating most in vogue for shops are: Direct steam or hot water; indirect steam with blower system; forced circulation of hot water.

The direct-steam system at comparatively low pressures is most favored in loft buildings, because by this system it is possible to heat some portions of the building without heating the whole of it, and because the first cost of installation is kept low by the short steam mains, and because there is usually a basement in which the heating apparatus may be installed so that it is possible to use a gravity-return system.

One-story shops are more likely to be heated by the indirect system where the air is warmed by blowing it over a nest of steam coils and then led by means of galvanized ducts to the various parts of the room. These ducts can be carried overhead and be made to discharge either horizontally or obliquely downwards at a sufficient height above the heads of the workmen so that they do not feel a direct current of hot air. When direct steam heat is used in one-story buildings, steam coils are usually arranged along the walls under the windows; but if the shop is large, this arrangement becomes entirely inadequate and it is necessary to resort to coils hung overhead out of the way or else to use a combination with the indirect system just described. When coils and radiators are used in a variety of positions, there is often a great advantage in using one of the so-called *vacuum* systems, where the returns from the radiators are brought together and connected to a vacuum pump, thus increasing the rapidity of circulation of steam without raising the pressure and without making the difference in temperature between the radiators and the room so great as to make the heating inefficient.

Hot water as a heating medium is not often used in shops; it has certain advantages, but the radiators are necessarily large, because the water cannot be safely maintained at much over

the boiling point. Sometimes a forced circulation of hot water is resorted to, thus cutting down the cost of installation by allowing smaller pipes and radiators. If the cost of power to run the circulating pump is not too much, then this system of heating is very satisfactory.

Methods of Ventilating

Heating affects production in some plants where certain uniform temperatures are necessary in order to keep the materials in good workable condition, as for example in the cotton industry; but in general the principal object of heating is to make the shop attractive to the workmen and keep them well and able to continue the work. For this reason, heating should not be considered without taking into account the ventilation. In the great majority of shops the ventilation is dependent on the agreeing of the employes themselves to have the windows open a sufficient amount to give the needed change of air. The result is that the weakest win, and those who declare that they will catch cold if the windows are open even a fraction of an inch, rule; and the windows are closed from fall to summer. Those who suffer from lack of fresh air are seldom so self-assertive as are the sufferers from colds, though in the aggregate the tight closing of the windows undoubtedly causes more suffering than if reasonable ventilation were provided. For this reason, it is desirable to provide means for ventilation that are neither accessible to nor noticeable by the employes.

The indirect steam-heat system furnishes a good means of ventilation, and one that is not in any way under the control of the employes, except as some very hardy person may venture to open a window. The air for circulation is taken from some outdoor source where there is a minimum of dust, and is distributed through the ducts of the heating system. If a comparatively dustless source is not convenient, the air may be run through a washer. Often in cold weather air from the shop is run through the washer and circulated again, thus saving coal. Discretion should be employed in reusing air, as under some conditions the air might contain impurities that would not wash out or it might be improverished. It has been thought that reused air might show accumulation of bacteria, but experiment appears to indicate that with proper washing such is not the case.

EQUIPMENT

Sources and Varieties of Equipment

Each specific business has its own equipment, so that the subject can be discussed here only in respect to general principles. The purchase of equipment depends on the nature of the business. Since ancient times the blacksmith has been reputed to be the one craftsman who is able to make all his tools himself. Today, however, even though he can make all the tools he needs, he finds that he can earn more money during the time that he would spend making them than it costs to buy them. At the other extreme from the blacksmith, are the various businesses in which no manufacturer expects to take any part in the manufacture of his machinery, and in which it is quite unlikely that he could do much if he wished. Such, for example, is the textile business, in which manufacture is extremely specialized, so that the mill owner buys his looms of one manufacturer, his finished machinery of another, and so on, but never thinks of building them himself.

A great group of industries is supplied with equipment by the machine-tool and wood-working machinery manufacturers. These people supply a definite line of machinery with which any of the usual operations in wood or metal work can be done. They also will build special machinery adapted to the product which their purchaser wishes to make; but often the purchaser of machinery of this kind will have some special machines which are secret, or which he hopes to keep secret, and so he runs a small machine shop of his own, using machine tools for the manufacture of his own special machinery.

Also, there are shops whose work is so specialized that no one else is likely to demand anything similar to it as, for example, the spool and bobbin shops, the manufacturers of horn and celluloid combs, etc. The makers of such goods for the most part buy their equipment from manufacturers who make nothing else and who give each purchaser the benefit of their experience. Occasionally a maker of some such goods will develop ideas of his own and will enter into the job of designing and making his own special machinery; but the shops making such goods are so likely to be small, that this seldom happens. Then there is still another class of manufacturers so specialized in their work that no one can afford to make a business of supplying them with machinery that is at all standardized. These are the makers of newly patented articles that have not yet come into common use and which have not yet induced people to dodge

the patents. Such manufacturers have to design their own machinery and experiment with it until they either stumble on something usable or else enlist the services of some expert designer who sees the opportunity to make a future profit and is willing to do the experimenting. In this class of manufacturers have been the makers of many of the notable inventions that have since become staple products, such as the telephone, wireless, the phonograph, etc.

Investment in Equipment

In the early stages of most small businesses, the simplest and most needed machinery is bought, and for a long time all the surplus that can be squeezed out of the business is spent in getting more and better equipment. There comes a time, however, when the entire question of investment in land, buildings, and equipment has to be considered. Nearly every business does a considerable amount of borrowing from banks. A business concern can borrow moderately from savings banks on its real estate. It can borrow more on a loft building situated in the business district of a large city than it can on any other kind of manufacturing property; it can borrow less on buildings of the shed type with traveling cranes, simply because the bank must look at the value of the building at forced sale. A loft building can be cut up into small rooms and used for many purposes; the other type is useful only for certain kinds of heavy manufacturing. Consequently the pressure from the financial part of the management is to use the loft building whenever possible. However, the equipment must for the most part be owned outright. It is seldom that banks consider the inventory of the machinery and tools as a basis for loans. They want to make their loans, other than those on the buildings, on a basis of quick assets, such as bills receivable and materials in process of production, on which they can realize quickly in case of necessity. Banks do not look with favor on machinery as security for a loan. In many cases they are right, because the highly specialized machinery used by many manufacturers is of no interest to their competitors, except as a curiosity. In many lines of business, progress has been so rapid that no one set of machinery has had a chance to wear out before something far superior has taken its place. Under such conditions, a user may find it to his advantage not to insist on weight of parts and refinements of workmanship such as would be proper for standard machine tools, since he is likely to find it profitable

to throw away his equipment and buy new much oftener than do the machine shops.

From this it will be seen that the amount of money that should be sunk in equipment depends greatly on the rapidity with which invention has proceeded in the past. It is never safe to assume, because great progress has been made, that it has come to an end; for the reverse is almost always true. Things that have been much improved in the past are being still more rapidly changed, while things that have stagnated in the past are only beginning to show signs of change.

It is desirable to keep these things in mind, because the engineering profession is inclined to look at the present dollars and cents cost of production and often to overlook the loss that must be taken whenever progress demands a change of equipment. Many factory concerns have found their business stagnating because their machinery was built for all time, and was so expensive that when the time came for it to be scrapped they could not see their way clear to take the loss. They did, however, take the loss, sometimes many times over, in the lack of increased production as compared with their competitors.

Methods of Manufacturing

There are two quite dissimilar methods of manufacture, the choice of which is determined by the nature of the goods. One is the continuous process, where the product goes along in a straight line, and various operations on it are performed and the product comes out at the further end of the building ready for shipment. This straight line is not necessarily a physical line, and it may have subdivisions or it may have tributaries. For example, in the manufacture of steel wire from the billet to the finished product, there is first the billet mill, in which by repeated passes of the billet back and forth through rolls it is reduced to about 4 inches square. This is then chopped up into about 4-foot lengths and reheated, run through a continuous mill, and comes out as a rod about a quarter of an inch in diameter. It is then shifted to draw benches and drawn down to the desired diameter. It is then ready for shipment, unless it requires galvanizing or some other collateral process. In all of these processes the manufacture has gone ahead; but after the billet mill, the bars may have been distributed to two or more rod mills, and after the rod mills the rods may have been distributed to a number of draw benches, as in each case the billet, which was perhaps 6 feet long, may easily make a hundred miles of small wire.

The other principal method is the intermittent, or assembly, method. In this, the product is made part by part, or unit by unit, and finally brought together in a completed whole. Some of the parts may be made and stored for a long time; some may be made especially for the particular unit that is to be sold. A notable example of this kind of manufacture is the engine lathe. A great many of the essential parts are small and capable of being made on automatic machines for a very much less cost than if made one by one; such, for example, are the bolts and nuts, capscrews, studs, and gears. These can very easily be made on the interchangeable plan with reasonable tolerances. They may be made in lots of a hundred or a thousand and kept in storage until the time comes when they are needed. The machines on which these parts are made do not stand idle while their product is being used up, but are put to work on other similar parts, so the continuity of operation is broken up. Other parts, like the aprons, feed works, compound rests, etc., are made in quantities of from a dozen up to perhaps fifty, and stored away. Then the large member, the lathe bed, or the ways, is made, sometimes in small lots for the most used lengths, sometimes on single orders for lengths not commonly called for. For example, a manufacturer of 18-inch lathes will usually try to have 8-foot and 10-foot beds in stock ready for shipment, or at least for immediate assembly; but if an order comes for a 14-foot or 16-foot bed, he will have to wait to have a casting made. The final assembly of a lathe of any length consists in putting the bed on to standard stock legs, fitting to it the headstock and tailstock brought from stores, scraping on a carriage and fitting an apron both brought from the stock room; then, while this has been going on, a lead screw and feed-rod have been made, if the machine is of special length, or brought out of stock for the ordinary lengths, and they are fitted; the machine is then tried out and is ready for shipment.

A combination of the intermittent and the continuous processes is used to some extent; notably in the manufacture of some motor cars, the sales of which are large enough to justify it. In this case the various parts are made and gradually assembled in something like the outline of a tree, Fig. 7, so that the raw material comes in at each of the tips of branches, has the necessary operations performed on it, and is assembled to the next part at the juncture of the branches. The assembled units are then attached to the main stem where the branches meet the trunk. In this process, the main body of the car, beginning with the frame, or chassis, moves slowly down the shop, and as

it passes the opening from each wing of the main building the proper parts to be attached at that point come out from the shop in which they were manufactured and are ready for assembly. The parts from each of these shops, however, may have had a similar method of assembly; for example, the engine has already been assembled by the same process.

The advantages of this method is that there is not so much money tied up in idle stock waiting for it to be needed. However, it is obvious that it is applicable only where there is assurance of a very large flow of work, such that the most trivial operation that is performed in the whole works will keep at least one man fully busy. Then other operations become simply matters of keeping a proportionately larger number of men

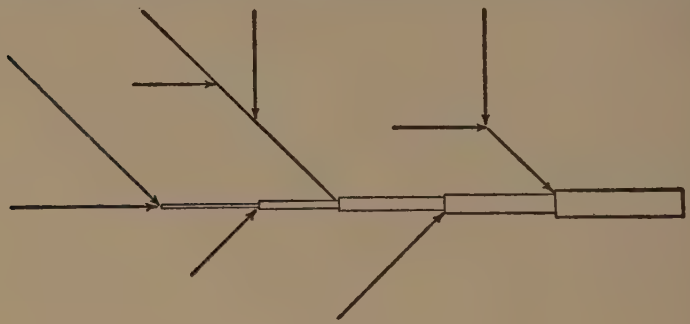

FIG. 7

on each individual job. This method has a disadvantage that must be weighed along with its advantages; that is, it discourages progress. Once the shop is arranged to carry out such a method of manufacture, it is very difficult, because expensive, to make any changes in the product.

A third form of arrangement of machinery is, the group method, or grouping machines of the same kind together. This is an advantage when the work is highly skilled or especially if it requires highly skilled supervision. For example, in a shop that requires a considerable number of gears, it is undoubtedly wiser to put all the gear-cutting machines together, so that the machine best adapted to the particular gear may be used. A complete equipment for a gear-cutting room comprises not only the standard rotary cutter machines for spur and bevel gears, but gear-hobbers and gear-shapers as well as bevel-gear planers. These machines scattered around a large shop become much less efficient than when grouped together with proper facilities for sharpening cutters.

The grouping plan has been carried to the extreme of having all the machines of each different kind grouped by themselves, the product of each being sent to some other machine for the next operation, with the result that in a shop of that kind the routings of the work become an almost inextricable tangle.

Routing the Work

Both of the intermittent systems require for their success a planning department to route jobs from one place to another and see that they are kept moving. A tangled routing, unless regulated by a planning department, can become very expensive in the increased amount of unfinished parts that are all over the shop. The continuous system of manufacture has the great advantage that there are practically no reservoirs along the way to be kept filled up, but the dams are all down and the stream of work can run along smoothly; whereas, in the other type of manufacture, there are innumerable eddies and backwaters in which material nearly done can stagnate.

There is nothing about the continuous system to prevent advantage being taken of a favorable market to stock up on materials. They simply go into a storehouse much less expensively built than the shop and remain there until required. When a stock is maintained all over the shop, it is mostly in a state of partial manufacture, and has cost something for labor, it occupies space adapted to manufacturing, it is in the way and has to be moved from time to time, all of which is expensive. The best planning department is the one that produces the output demanded with the smallest amount of partly manufactured goods in the shop.

Equipment for Handling Materials

The size of building required for a given production is effected by the equipment for handling materials.

In a loft building, elevators are an absolute necessity; the stairways should be solely for fire escapes, as the elevators should be available for all transportation between floors. The location of the elevators depends on the use which is to be made of the different floors; but, in general, the center of the building is advantageous, as that has the least natural light and the space for the elevators and space for trucks waiting for them is least useful for other purposes. Definite lanes from the elevators to different parts of each floor should be provided and kept clear of all materials except those on moving trucks, otherwise the

shop becomes so congested that costs go up on account of delays.

If the center of the floors must remain open, it is better to have the elevators at the center of one of the long sides of the room, as the lines of travel are then only slightly longer than if the elevators are in the center. As a general rule, if there is more than one elevator to serve a building, it is better to group them together; not merely because of economy of installation, but because then, when a man comes with a truck load of materials, he stands a much better chance of catching an elevator going the way he has to go than he does if the elevators are at opposite ends of a floor, in which case he will be likely to find the nearest one going the wrong way or not going at all.

Traveling cranes are an absolute necessity for many forms of work, and are therefore not a question of debate; however, there is often a question in regard to the arrangement of buildings served by them, as to whether there should be one very long and narrow building with several cranes all on one runway, or whether there should be several buildings parallel to each other, each having a separate crane, and all connected by a sort of transfer table across one or both ends. The latter arrangement makes possible a shop with less distance for executives to travel, and for the intermittent type of manufacture is much less likely to cause long lines of travel for materials in process. The long shop may be slightly less expensive to build, but it necessitates a transfer of loads from one crane to another if they have to go more than to where the next crane is in use; and this transfer is not much less expensive than the transfer to a transfer table, and then to another crane.

Other conveying mechanisms to be reckoned on in the construction of the buildings are tracks for industrial railways, belt conveyers, bucket conveyers for carrying bulk material from floor to floor, the various small, hand-controlled traveling cranes used for light loads and for serving machines. These various mechanisms are made necessary by the methods of manufacture decided on, or else they are a matter of judgment in choosing between a low labor cost and low overhead charges. They are necessarily expensive, but manual labor is both expensive and unsatisfactory. Moreover traveling cranes of whatever type are not subject to especially rapid improvement, and they may be used and sold afterwards without the very great sacrifice that is made with more specialized equipment.

MANUFACTURING

Control of Materials

All Manufacturing Requires Raw Materials.—Control of raw materials of manufacture is important, so important that lack of that control is a constant menace to any firm's solvency. The shop may be so small and insignificant that no one is tempted to put any obstacles in the way of its purchasing whatever it wishes at a price somewhat below the retail market, but much above cost. For example, a small shop may buy its materials all manufactured, and merely assemble the parts, put its own name on the finished product, and market it. This is the way in which many automobiles are made. The engine is bought from one shop, the transmission from another, the body from another, and so on, until the company's own shop has only an equipment consisting of a welding outfit, a few wrenches, and a paint shop. Such a concern, however, is in a rather precarious condition; because the moment it appears to be making a profit there may be an increase in the price of supplies and parts. This increase may be perfectly legitimate; for some of the concerns from whom component parts are bought may have given very low prices in order to help the new firm get a footing, and they may feel that it is legitimate for them to get a little larger share of the profits. Also, competitors of the first-mentioned firm are bidding against it and each other for the product of these manufacturers of parts, and the result of this bidding may be unexpected changes of prices that may seriously reduce expected profits.

At the other extreme from the conditions just described is the large concern that owns the original sources from which the principal materials it uses are derived. The United States Steel Corporation, for example, owns coal mines and iron mines, and undoubtedly many other sources of supply for things which it uses in lesser amounts. Such ownership gives them a commanding position in the business.

There are, however, dangers connected with the owning of such resources. For example, a firm using large amounts of copper might own copper mines. Such mines are usually deep and expensive to operate. If, then, their mines were of this nature, and other mines were discovered where equally good ore could be mined with a steam shovel working in an open cut and loading directly into standard-gauge cars, the worth of the deep mines would be reduced.

Also, unless a firm has abundant capital, it is unwise to tie

up so much money in such property; for in times when money is scarce, banks are not likely to consider mines to be good collateral for a loan. In fact, it is probable that more firms have failed through trying to cover too much of the range of manufacturing operations than through failure of materials because of lack of their own sources of supply.

It is, of course, easy to show that there must be a profit made at each step of the process of manufacture, and that if all the processes are carried on by one concern, all these profits can be combined. Nevertheless, it must be admitted that specialization makes it possible to make a profit where none would appear to a shop doing all of the operations on the raw material. For example, a concern that makes crank-shafts for many different kinds of automobiles must necessarily get together a body of experience that no one automobile maker could possibly get. Moreover, such a concern can afford to make tests of the billets offered, have specialized machines in its equipment, and take many advantages by which it will be able to make a profit at prices at which no profit whatever would appear if each automobile factory were to make its own.

Control of Sources

Industrial history appears to bear out the advice to go slow in extending manufacture too far back from the finished product. Every possible precaution should be taken, however, to make business connections so that materials partly manufactured may be obtained regularly, and in such quantity as is needed. This may be accomplished by two means: in one case by beginning manufacture in the plant at one of the accepted stages, so that there will be many sources of supply and numerous bids may be obtained; the other is by making contracts with other firms, and they in turn with others, so that the effect of a continuous supply from the original sources is obtained. This latter arrangement may be made by a system of interlocking directorates, so that each firm that passes along the product of another firm is well represented on the board of the firm from which the product is received. A similar result may sometimes be obtained by personal favor, as in a case where people who are members of the same society, church, or lodge will protect each other for sentimental reasons only.

Another case where the supply of material is assured is that of a firm organized to use the scrap made by a larger company. An example is a small shop making counters, the part of a shoe around the heel, out of the scrap leather produced by

a large manufacturer of leather specialties. In this case the small concern is organized within the larger one, possibly with the same officials, and is therefore assured of a supply of materials as long as the large firm exists.

Even when a large firm owns its original sources of supply, it is quite common practice to organize subsidiary companies to conduct certain of the preliminary operations. For example, a large rolling mill may own the majority of the stock of a blast furnace, a railroad, and an iron mine, as well as of other apparently independent companies operating coal mines and coke ovens. In this way all the good effects of complete ownership of the whole plant are secured, with the advantage that in case of stress each plant can go out after outside business. In fact, each plant is usually careful to have some customers in different lines than the next firm in order, so that in time of necessity it can send out a sales force after more business and keep running, even though the company which usually puts the finishing touch on the product may be destitute of orders.

A small shop just starting may lay its plans for expansion, and hope for the time to come when it can snap its fingers at everything except the labor necessary to its success; but at the beginning it may very well conserve its credit by doing the very least possible manufacturing in its own plant, consistent with turning out the distinctive product which its salesmen can present without fear of criticism. An example of such manufacturing is presented in the making of milled screws. The raw material is cold-rolled steel and the product consists of milled screws used to assemble machinery. Cold-rolled steel is made by a multitude of steel mills all over the country, and the screws are used by a much larger multitude of manufacturers. For this reason it is a "safe" business from a banking point of view. Its raw materials are salable in case of stress, and its finished product can always be sold at some price; also, the time between the delivery of the raw material and the delivery of the product is short. In every way the business is a conservative one which will have only a small margin of profit, but which should pay some dividends yearly.

Ownership of a Foundry

In connection with the insuring of a supply of raw materials for manufacture, the question frequently arises as to whether it is advisable for a machine shop to have its own foundry. There are many shops that use iron castings as raw material and buy from foundries; there are also many foundries that turn

out castings as a finished product and need these shops as customers. Therefore, it is perfectly natural for one to become the customer of the other. However, in the growth of nearly every machine shop there comes a time when a jealous eye is cast at the profits that are made by the foundry; or friction arises over delivery. Then a foundry is considered, either on the basis of the profit to be made directly, or on the basis of the gain from prompt delivery of castings. In some cases the foundry is built and everything is successful, in other cases the foundry is given up and the loss taken and the old way resumed. The difference may be caused by quite a number of circumstances. It is safe to say, however, that unless both the machine-shop department and the foundry department are independently profitable, the combination is not likely to be kept alive long.

Success in a foundry means the making of suitable castings for less money than is paid or credited for them. Success in the machine shop is rated in similar terms. A company that operates both a foundry and a machine shop has to set a price at which castings shall be credited to the foundry. It may credit them at cost, which leaves the foundry organization with nothing to work for, unless it is to hold their jobs; and that is a most unsatisfactory incentive. If castings are credited to the foundry at the market price, then the only gain resulting to the machine shop from the foundry will be through receiving a better quality of castings. This method is better, for the foundry has the incentive of making a profit at the market price and of providing castings of the quality needed for easy machining, strength, or whatever may be required.

Where the foundry is credited for castings at the market price, it is very essential to decide in advance what the standard of quality shall be and how it is to be tested. This decision should be reduced to writing and lived up to. No departure from the standard should be allowed unless it is formally agreed upon and reduced to writing. This is equally important with any similar arrangement and is not limited to foundry operation. The most difficulty will be experienced in defining the quality of the castings required. Once the conditions by which the foundry is to be judged are determined, there will be little trouble, as a superintendent who cannot make good under the specifications will resign without waiting to be asked.

The most common cause of failure in foundries is lack of suitable equipment. There are many profitable foundries in existence that do not appear to have any worth-while equipment, but that is not a normal condition. All the sand that

goes in a flask has to be rammed, and if the flask is twice as big as it should be, the mold will cost more than it should. If the only flask that is available is too small, there is danger that the sand will fall from the mold when the pattern is drawn. Pneumatic sifters and rammers have become a necessity, and so on, the foundry having by no means been neglected by inventors and engineers.

The quality of the castings is of great importance in any machine shop. They should be soft enough to machine easily and hard enough to wear well. They cannot be strong or hard enough for certain uses and still be soft enough to satisfy the planer foreman; therefore, they should be subjected to definite tests for whichever qualities are most necessary.

Promptness of delivery, especially of emergency castings for repairs or replacements, is of great importance in some kinds of manufacture. However, it is likely that if the cost of this promptness is determined clearly by the cost-accounting system so that it is included in the price, the conditions will be gladly met by the contracting foundry. Of course, a jobbing foundry cannot play favorites in making deliveries unless it can show that it charges a fair price for the accommodation. It is often necessary for a company to have a foundry of its own for a time in order to learn for itself just how expensive and difficult these special deliveries are.

The same principles that have been touched on in connection with a foundry as an adjunct to a machine shop apply equally well to many other contributory processes in manufacture. They apply to a mill at which it is decided to have a repair shop, to a shop that ships its product in boxes or barrels and starts a box or cooper shop; they apply to the manufacture of dyes in textile factories or inks in printing shops, and to a great many industries.

Too often, factories for making these things are started to show some one else how independent the management can be. Sometimes the provision of such resources and facilities is justified; for example, in a town where the electric light and power company has a history of variable prices, it may pay very well to maintain a steam power plant ready to start up at a moment's notice; or, when a change is made from coal to oil-burning furnaces, it may be wise to preserve the chance to change back very promptly.

PURCHASING OF MATERIALS

The Purchasing Agent

Once it is determined where manufacture will begin, the next step is to make the purchases. In a very small concern this work is naturally placed in the hands of one of the owners. As the shop grows, this person becomes treasurer, then he hires another man to act as his assistant and take over the buying. This assistant takes the title of purchasing agent, and is immediately studied by firms from whom he might purchase supplies in ordinary times, and his weak and strong points are noted in a thousand card indexes. If he is rated as being a sensible and fair-minded man who does not overlook the fact that he is hired for the purpose of saving money for his firm, he will be honored by the visits of the very best men on the selling staffs. There is no place where the old saying, "Nothing succeeds like success," is any more true than in the office of the purchasing agent. The capable buyer attracts the capable salesman. He does not have to spend as much time over his purchases as he would if the mediocre salesman were sent to him, and he secures a great deal of really expert advice for his firm gratis. A purchasing agent who has a good reason for taking one man's product and not another's will usually be willing to state his reasons in such a way that it is profitable for the salesman to listen. Good salesmen know it and act accordingly.

Every firm has need of materials and supplies, some of which may be classified as staples and others as emergencies, or as major needs and minor needs. Those which are both major needs and staples, require the most constant and thorough attention. The emergencies may become major demands; for example, in time of expansion into new buildings the purchase of equipment is a very necessary thing, and one in which the purchasing agent may well take a hand, in spite of any detailed knowledge which the engineering department and the works manager may have. On the other hand, a purchasing agent should not spend too much time on the purchase of supplies of small value, if thereby he must slight the purchase of staples.

Tabulation of Needs

It is most necessary that the purchasing agent be able to look ahead. His is more or less of a speculative position no matter what he may wish. If he buys hand to mouth at the market, he may pay a high price for his conservatism or he may

save much money, as the case may be, but if he knows how much of a given product he will be sure to need in a year's time, he may be able to secure very decided concessions. Consequently, it is a growing custom among purchasing agents to set a maximum and a minimum for each of the staples that must be purchased. The maximum is the largest amount which the purchasing agent can carry in stock without special approval of the management, the minimum is the amount at which he must take steps to have a new supply coming in. For example, a concern using 12,000 tons of coal per year may decide to carry not over four months' supply and not less than one month's. Then, whenever the amount in the bins, as shown by the stock or stores department, is reduced to 1,000 tons, the purchasing agent must buy, whatever the market; but up to that time, whenever the amount is less than 4,000 tons, he will be on the lookout for bargains, which he will take over whenever he feels that quality and price make it advisable to do so.

This system is applicable even more to smaller supplies. For example, the supply of ink required in the office may have just as definite a range as the coal supply, in fact the purchasing of it may be made entirely automatic, so that the orders may be given by a clerk in the purchaser's office and not have to come to the purchasing agent's attention at all. The same is true of the large number of supplies which may be rated as staples and minor supplies. To care for these, all that is required is that a report be made from the stores department whenever the stock of each article reaches the lower limit. These limits should be set, however, by the purchasing department, as it is necessary to change them from time to time according to deliveries. For example, suppose that a cutlery factory uses grindstones. If transportation is normal it may be possible to make a purchase and get the stones in the store room in two weeks. If the demand for grindstones is great or if transportation is congested, it may be necessary to start the purchasing machinery in motion four weeks ahead of delivery. In that case, instructions might be given to the stores department to report reduction of stock on hand to the purchasing department much sooner, or before the actual number of stones on hand reached the point at which the purchase must be made.

Sources of Information

Many persons think that the duties of the purchasing department are only those of selecting from the goods offered by salesmen. Such buying is of course important, but the man

who depends entirely on goods being brought to him must have very great confidence that his firm is well known and that he is in very good favor. For example, a number of years ago there was a firm so unfavorably known all over the eastern part of the country that no salesman went to them with any idea of quoting bottom prices on goods. They were always finding fault and demanding concessions, and yet they were a prosperous and well-financed concern. If they depended only on the price brought them by experienced men on the road, their loss must have been very great. The best purchasers do secure the cooperation of the salesmen, but they also travel freely themselves and make the acquaintance of the people who manufacture the things which they need. Certain supplies are highly technical. The purchaser of inks for a printery, or the purchaser of grinding wheels, has to depend on the reports which are given him by the foremen and workmen in his plant, unless he enlists the services of outside experts. In the case of grinding wheels, for example, he can have an expert come from the factory and demonstrate the possibilities that his wheels have. In this way he is sure that he is not being hoodwinked by some foreman who is receiving favors from some agent for another make of wheel. This only illustrates one of the many ways in which the buyer, in order to protect himself in cases where he cannot be expected to be an expert, enlists the services of others.

Testing Materials

It may be wise in many cases to prepare specifications that require the material to come up to definite tests. Then a testing laboratory may be necessary or else confidential relations must be entered into with some commercial laboratory. It is not always enough to depend on the expert services of a manufacturer or wholesale house. An example of this is shown by the experience of a machine shop when the management wished to make sure that they were purchasing the proper lubricating oils. Everything appeared to be all right with the oil they were using, but another firm had offered oil which they guaranteed to be better and at a lower price. In order to settle the matter, the purchasing agent called for samples from several oil concerns, including the one that offered the new oil and also the one from which he was then buying. The latter told him to take their sample from the stock that he was using, but also offered a new oil at a slightly advanced price, which they said would be found to be worth much more than the extra cost. The oils were all submitted to friction tests at different tempera-

tures, from which it was possible to discover which oil produced the lowest coefficient of friction at the ordinary running heat of around 100 to 110 degrees. It turned out that the worst oil was the new one that was offered by the firm that was regularly supplying the oil. It was not at all suitable at the normal running temperature, since it only got into action at upwards of 140 degrees, which was too high for safe working on ordinary shop lucrication. The newly offered oil from outside was but little better, though it began showing a low coefficient at around 130 degrees, while the original oil that was in regular use showed so much better results at the ordinary temperature that it was discovered that the shop could not afford to accept as a gift the new oil offered by the competitor, much less the new oil offered by the firm that already had the contract. Inquiry developed the fact that in making up this latter oil they had added a small amount of very heavy cylinder oil, which was not intended as a lubricant except under steam pressure at upwards of 212 degrees. In this instance the purchaser did a real good to all the parties to the test, as he showed them the results of trials under conditions which approximated those of regular use much more closely than did the viscosity tests and chemical analysis to which they were accustomed.

Material Specifications

It is becoming more and more customary to buy supplies on specifications and to conduct tests to see that the goods are up to specification. The old guarantees of "best quality goods of good workmanship" have served their purposes and have been relegated to the place where they belong among the uncertainties of the past. No one would think of ordering steel today without specifying the number of points of carbon which it shall have, or, if it is an alloy steel, what the percentage of the various alloys of nickel, vanadium, or whatever is desired, shall be. A great many of the ordinary supplies have not, however, yet been reduced to such a scientific basis that they can be ordered safely purely on specification. For example, leather belting is still very dependent on the selection of the leather by experts who are not able to reduce their own method of selection to rules which can be followed by others. The cutters likewise do their work by virtue of long experience and a knowledge of leather that is almost uncanny. Lumber likewise is graded, but the grading is done by very human men. It is done very rapidly and many times the lumber will go in a different grade at the end of a hard day's work than it would in the morning.

In the buying of such materials the purchasing agent can only be guided by the best experience that he can find. He will usually pay quite a little more for his supplies of such nature than he would if he were buying on price alone, but the difference he will charge up to insurance against disappointment when the goods are put into use. A house that does make good selections of material and that will not allow itself to be drawn into price competition, and that can be entirely depended on, is the house from which to buy materials that are difficult to specify, while on goods that can be surely tested and the manufacturers of which know the test to which they will be submitted, it is safe to send out specifications and allow whoever will to bid, care being taken to be sure that the bidder to whom the contract is awarded is able to fill the order.

Payment for Supplies

Every firm has the problem of cash discounts and the problem of inspection, and these are likely to overlap. Goods are billed on the date of shipment, and cash discounts are offered, usually for cash in 10 days from date of the bill. At the time the payment must be made to secure the discount, the goods are still in transit, and there is no check on the quantity or the quality. Dependence then must be placed on the firm from whom the goods are bought to make sure that they are as billed. It is quite the custom to take the discount whenever offered and leave the matter of a final settlement to be taken up after due inspection of the goods. This is not altogether satisfactory to either party to the contract. Once a firm has the money for a shipment of merchandise, it is very hard for them to give it up and make a rebate. They will consequently make a much firmer stand against criticism of the goods than they would if the money had not been received. Cash discounts, however, are very much worth while, as they represent higher interest rates on money than are ever asked by the banks except in times of great money shortage.

ORGANIZATION

Form of Organization

After a supply of labor and materials is made available, and the buildings and equipment are ready, it becomes necessary to organize the production department so that it will run smoothly and do progressive work. In the past, organization has been largely a matter of evolution. One man, or two or

three partners have begun without any visible organization. Their business has grown, and while each still kept an eye on everything done they each assumed a certain amount of responsibility. Then as they employed minor executives, and, with still further growth, higher executives, they have found themselves obliged to make definite divisions of their work, lest they put these employes in the position of trying to work for more than one master.

Line Organization

When the shop is started by one man, the problem is usually simpler than that just described, though the solution is not necessarily much more satisfactory. One-man control makes for action and prompt action at that, there is never any

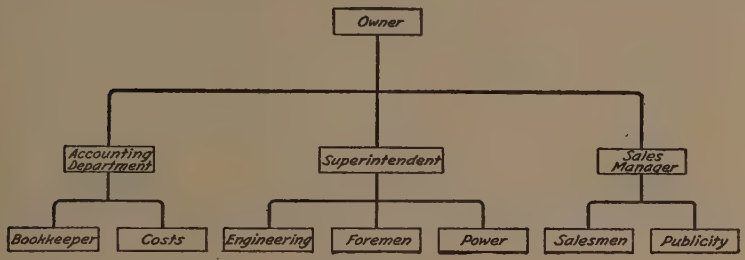

FIG. 8

question whether a decision may be obtained on any point and at once; for the type of man that does not make decisions is not likely to have a growing business. The founder will most surely have what is known as a *line* organization. He will be the head; under him, each in charge of specific things, will be two or three subordinates, probably the superintendent of the shop, the head of the sales, and the bookkeeper, or head of the accounting force. These men will pattern their conduct after that of the owner, each will be a king in his own department, and each will feel free to order the others out of his own particular province if the mood strikes him. They will hold their jobs by virtue of fitting the personality of the owner, and he will be unwilling to discharge them, no matter how independent they become, because they have grown up with him and they fit him as an old shoe fits the foot. This same form of organization is passed along down the line, from which the form takes its name.

Fig. 8 indicates the course of authority in a line organiza-

tion. One advantage of this organization is that it makes one-man control possible over a large business. A notable example of line organization is the army, where each private is under a corporal, the corporals are watched over by the sergeants, and so on. In this form of organization no man can step out of his place without being noted, and mutiny is almost impossible. On the other hand, it is true that the very organization that makes it so easy to maintain discipline also prevents men from becoming of any value except that assigned them by some one higher up. It practically makes it necessary for each person to wait for some one to die in order to obtain promotion.

In a business concern, the line organization is especially apt to bring about internal politics or government by favor. The man at the top, by very virtue of his position, can see but a little way down the line. He knows his immediate subordinates thoroughly, but he is only aware of the existence of the next tier of people, and the workmen themselves are so far removed that his only impression of them is that which remains in his memory since the time when he was a workman himself. If that memory makes him desirous of giving his workmen a fair chance, he has no opportunity to insure that they get it, because his orders go through so many hands that they may be distorted before they reach their destination. As a general rule, each man in such an organization will take the position that he is to be judged by results only, and that the details of how he gets the results are not of any importance to the people higher up. This form of organization is by all odds the hardest in which to do improvement work, whether it be better employe relations, methods of manufacture, handling methods, or what not; because intense jealousies are everywhere present, and every foreman is afraid that he will in some way lose prestige if he allows any one but himself even to know how he conducts his department.

Line and Staff Organization

In the process of evolution, the line organization is likely to find it necessary to introduce experts as advisers to the owners of the business. It may be that these will first be called in for some emergency. As a rule, this practice is not begun except in extreme necessity. It may be that competition is keen and that the firm does not see any way to meet it, so, rather than give up without a struggle, some outside consultant is brought in. If he is successful, he may be asked to make a permanent connection with the company, for fear that he may pass along his acquired knowledge of the business to some other competi-

tor. Once the line is broken by this expert, there is likelihood that more will follow.

The staff may include the engineering department bodily, it may include experts in accounting and in safety engineering; in fact the whole employe-relations group, except the section which actually hires men, may come under the head of staff. Then there is a possibility of a laboratory for the testing of materials bought or the product of the firm, or for experimental work. All of these departments generally report directly to the general manager, except, as will be explained later, in cases where the committee system of control is in force. There are also exceptions in the case of the engineering department, which in many cases is a part of the line organization and is under the works manager. It is an open question whether the design of the company's product should be exclusively in the hands of the production department. It seems that the sales department is in a position to know what the market demands and to know what talking points should be incorporated in the product to make the sales easier. If the engineering department is concerned only with the design of buildings and in providing equipment, there can be little question that it should be directly responsible to the general manager, so that it can have the advice of both the sales and the production departments, but will not be controlled by them.

A laboratory is very likely to be a part of the production department, except as it is engaged in experimental work looking to additional products or to improvements on the old. If the laboratory is for testing the product of the concern, it surely should not be under the production department, but should come at least one stage nearer to the general manager; since, if it is under the production department, it is practically inspecting its own work, and will be subject to all the temptations and influences of the production department.

The department dealing with employment and its related work should most surely be under the highest official of the company who is able to give it attention. The office that does the actual hiring of shop employes may well be under the shop superintendent, as it is an executive office and very directly connected with production. But the interviews with the men leaving the shop should not be in any way influenced by the shop organization, nor should the safety work, the medical work, the feeding, the follow-up, or any of the other functions of the personnel departments. These departments must necessarily at times find much to criticise in the production department; but

they are seldom placed in a position to do more than make recommendations. Those recommendations, however, will be such as to require executive action on the part of some one else to put them in force; therefore, the departments should be in a position to present their advice to the head of the whole organization and should most assuredly be in a place where they can do their work without interference by the production department.

Organization Charts

There are three varieties of organization charts. The most common form, the strictly *organization* chart, shows the line of

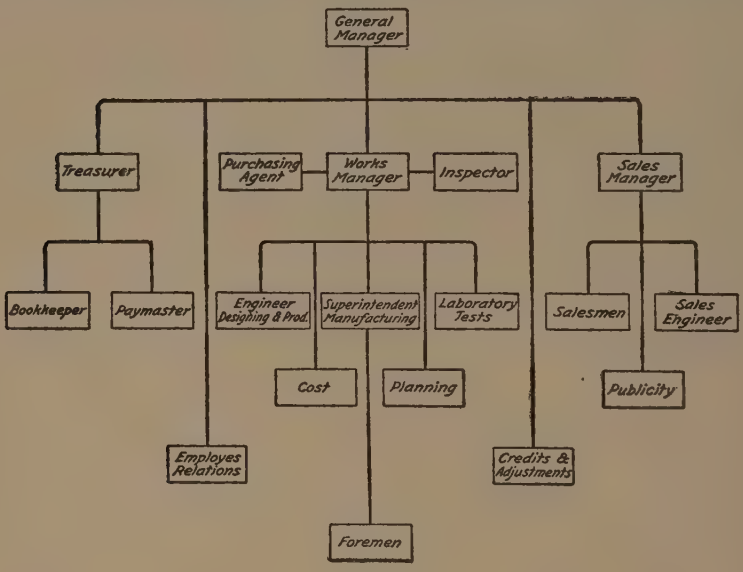

FIG. 9

authority. The *function* chart shows the functions or duties of the various officials or departments. Another chart is the *flow sheet,* which shows the flow or movement of orders, materials, or ideas in the carrying on of the work.

The first value which these charts have is that they bring before the management in a bird's-eye view just what the "kinks" are that prevent free flow of orders, material, and ideas. Many a firm when confronted with charts showing just what is going on in its plant has cut down the amount of red tape and expedited production thereby. It is often found that many things have to be approved by man after man who has no interest in them, but who does it merely to maintain personal pres-

tige, and by men who sign everything as a matter of course, not even reading what is put before them.

The one great danger in using these charts is that they will be used and referred to only in defense of some procedure, and that they will be overlooked or overruled in the ordinary course of business. It is not at all unusual to find charts that lcok well, but which have been so fully superseded that they have ceased to be anything except ornaments on the walls. If kept

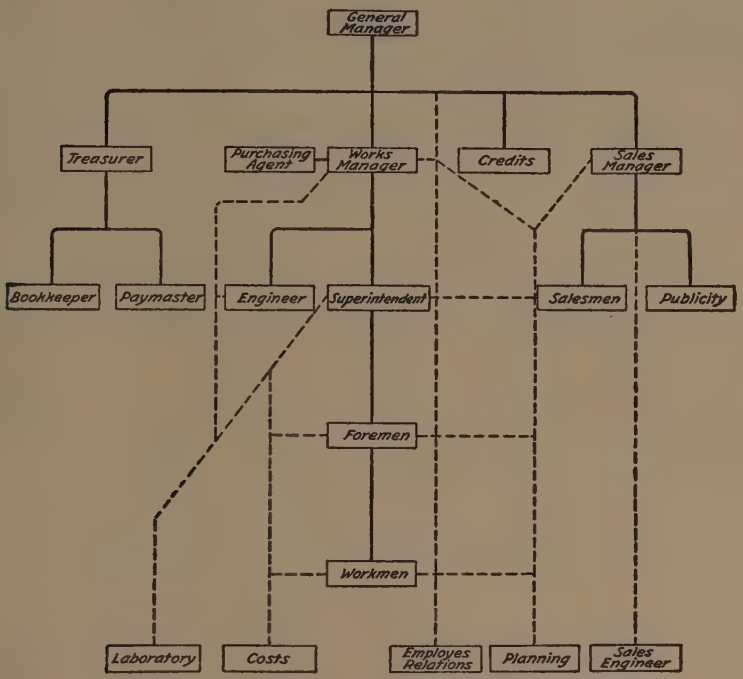

FIG. 10

up to date and respected by every one, including those who are responsible for them, charts are a great help. To a subordinate, they are most necessary, as otherwise he does not know to whom he is responsible for certain things and from whom he should accept orders. Of course a subordinate cannot refuse to do anything required of him by the president of the company, but if he can say, "Will you look out that my superior knows about this and arrange so that he will feel all right about it," then he reminds the president that the latter is stepping out of his own organization to go past a subordinate. Moreover, an

organization chart should be available to every one. It should not be a secret, but should be a usable and much-used tool at all times. The time-honored saying that "no man can serve two masters" is forgotten many times a day in some otherwise excellent shops.

The functional chart is of the greatest value, though not so often found. Lines of authority are very necessary, but modern business is going less and less by authority and is falling back on common-sense cooperation, and is trying to secure organizations that will function well because men know what part they are supposed to play and where their responsibility begins and where it ends. Whenever a firm that has been in operation for many years draws a truthful chart of the functions performed by its people, there is usually great surprise at the way evolution has twined and twisted things together. Many parallel functions are found exercised by different men, and the same man is found exercising functions of such different nature that a mental gymnast would be required to go from one to another. Most charts exhibit a combination of the line of authority and of function in their make-up, as shown in Fig. 9. A better form for such a chart is shown in Fig. 10, in which authority is shown by full lines and advisory relations by the dotted lines.

Flow sheets are a great help, especially to new executives, who are likely to make mistakes that slow down production through ignorance of accepted procedure. A flow sheet illustrating the steps necessary in changing an employe from one department of a shop to another is shown in Fig. 11.

Flow sheets are applicable to the movement of material from the time it enters the shop until it is assembled and shipped out; they are also applicable for small steps in the process, for the flow of ideas from the shop back to the office, for procedure in getting out circulars descriptive of the work and product, for the making, acceptance, and execution of new designs, and for every purpose where more than two men have to cooperate in accomplishing anything. There is no need of making flow sheets for every instance; but the moment any question arises regarding a division of responsibility, or an executive finds himself unable to decide to whom he should send anything for the next step, a flow sheet should be made and adhered to.

Division of Functions

There are only a limited number of minds capable of handling accounting, that are also mechanical; even fewer that are mechanical also have executive ability, though there are more

that combine executive ability with accounting. Then there is the type of mind that sees things from the sales point, that is, from a detached position, as through the customer's eye rather than its own, and that ability is seldom found combined with any of the other types of executive. In general, the functional organization of an industry should be such as to allow the individuals who are available to take upon themselves the duties which are most congenial and in which they have the greatest

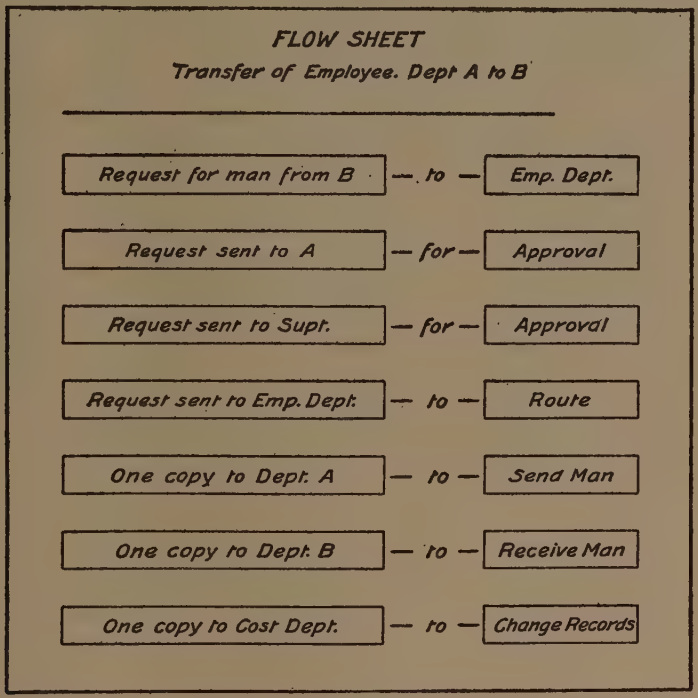

FIG. 11

ability; however, it is seldom that a large organization does not find itself obliged to place some man in a position for which he is not adapted by nature or temperament. For example, a firm may find that it has two men equally capable as traffic managers and no one that is above par as head of the stores department. It may be necessary to place one of the two traffic managers in the stores department, even though that may not be the best place for him, and to pay him a salary commensurate with his ability, even though a good store keeper might be found for less money. The safety in having a man who can step into

the traffic department is worth the extra cost of keeping the other man in stores. These conditions are found in nearly every large plant in some place or another.

Functions naturally divide into the large groups, such as production, sales, accounting, and so on. Sometimes a good salesman and a good production man are found in the same person, and sometimes a good accountant may make a good salesman, but very seldom does a good accountant have any desire or ability to get into the shop. Shop men are constantly wanting to get on the road, and in highly technical industries they are likely to make good. This distribution of ability makes it quite desirable that the time-keeping department, the clerical people in the stores and the stock departments, and similar employes in the planning and cost departments should be under the direction of an accountant. This is not a usual division, as these departments are quite likely to be under the works manager, if not under the superintendent himself. It so seldom happens that a man who is suited by training or temperament to the superintendency of a plant is at home in even these simple forms of accounting, that the real control of such work is usually found in the accounting department, even though the men who do the work are nominally under the control of the shop man.

It is a very common thing to find a superintendent who maintains that, in order to keep up discipline and maintain his authority, it is necessary that everything inside the shop limits shall be under his absolute control. He considers himself responsible for production, and reasons that he cannot be held responsible for that which he cannot control. There is enough truth in his reasoning so that it is worthy of consideration. If the organization does hold him personally responsible and washes its hands of all its responsibility, then he may be right; but he has assumed a place that any man should consider deeply before he takes it; for if he is literally without the support of the rest of the organization, he is likely to lose his job whenever business conditions which he cannot control, make business poor. If, on the other hand, he expects the hearty cooperation of the other departments in both good and poor business conditions, then he ought to concede the necessity of their having a constant knowledge and check on what his department is doing.

Whether the stock department, the planning, and the shop-order departments shall be under the superintendent, the works manager, or the general manager, is governed by the way the firm is organized as to this cooperation or lack of it. Planning, as will be explained later, is something that is technical, so far

as executive work is concerned; engineering, so far as the future is concerned; and accounting, as to its records. For this reason it would seem wise to place planning under the executive who controls all three of these departments, who in some cases is the works manager, more frequently the general manager, but seldom the superintendent.

The finished-stock department likewise comprises distinct functions within itself. It may easily be technical in such shops as make products used in engineering. Thus, in the manufacture of grinding wheels the stock rooms becomes of great importance, owing to the great variety and range of wheels required; and the stock keepers have to know which wheels will be considered interchangeable in different parts of the country and for different machines. For example, an order for wheels for saw gumming from Alabama requires quite a different wheel from an exactly similar order from Oregon, owing to differences in lumber sawed and in customs. However, any well-organized stock room maintains a perpetual inventory, which is really an accounting function. Moreover, the sales department has a vital interest in seeing that stocks are maintained of salable goods that may become emergency goods under certain conditions. A manufacturer of farm implements knows that weather conditions, which he cannot predict, may make a considerable difference in the number of sprinklers required for spraying Paris green on potatoes, and that the rush demand, if it comes at all, will be at a certain definite season, and that if the shop gets two or three weeks behind its schedule it may make a great difference in the profits from the sale of such apparatus.

The order department may appear to be distinctly a sales department affair, but the shop may have a very large interest in the way orders are divided up into shop orders. A rubber-shoe factory may have lasts for so many thousand shoes of certain sizes, and will want its orders to come in multiples of that unit rather than exactly as the order comes from a customer. But, the sales department knows the conditions, so that it can best say in what sequence the different parts of the order shall be delivered, and knows whether in order to retain customers it may be advisable to make the shop cost slightly larger by splitting an order and letting a smaller order come through between the parts of the larger one.

Cooperation

From the foregoing it will be seen that it is virtually impossible for any department to take its stand entirely independent

of the rest, but that full cooperation is necessary to secure the greatest profit possible. Habit has in many industries made the manufacturing department very much averse to so-called interference, but this attitude has often been changed by resort to the committee system, as explained later, which softens the blow that the production department feels has been dealt it when any of its privileges are taken away. This method appears to be a very good one, because in a committee conference in which the superintendent meets the sales manager and the accountant face to face with the general manager, the superintendent realizes that he is outnumbered and that he must present not statements alone, but arguments. The question of discipline under divided responsibility is a grave one, but not so vital as many superintendents think. As a matter of fact there is no such thing as discipline possible in a shop, in the sense in which the word is commonly understood. No punishment of an employe for violation of rules is possible. Once hired, he must be paid according to the agreement so long as he is retained on the pay roll. Of course, the law is infringed at times, but for the most part employes are fully aware of their rights and insist on them.

Committees to Aid Cooperation

Corporations that are an outgrowth of a family concern are very likely to make considerable use of the committee system. In such a case, instead of some one man's assuming authority and making a decision, that might hurt the feelings of some one else whose good opinion is of more importance than dividends, the matter is taken up by a committee in which all interested in the matter are represented. For example, it may be that the heads of such a company are not agreed as to the best way to handle a certain matter. Instead of allotting the matter to one man, a committee is formed in which all who have differing ideas are represented and that committee calls in every one who, it feels, might have suggestions of value, a vote is taken and everybody feels good natured about it. However, the process is so slow that, while the committee is coming to a decision, one man with the requisite authority might have the whole plan in operation and be at something else.

There can be no doubt that the plan of doing business by committee conference is slow, but it is in line with the advancing wave of democracy in business, and probably will increase rather than retrograde. The present tendency is toward committees to decide on policies that are to be put in execution by

individuals, in which case the committee becomes a functionalized part of the staff, advising the general manager what to do before he issues orders for the line officials to carry through. These committees may be formed at will for the solution of any perplexing problem, or any matter in which there is not unanimity among those in control.

Shop Committees

In some industries, shop committees are finding a place in the business organization. These have usually been started to offset union activities, but in many places they have functions quite different from those relating purely to wages and hours of labor.

The theory of the shop committee is precisely that of the committee of the management, a plan to assist in smoothing out things where personal jealousies might make a rupture. The shop committee can hardly have executive functions and thrive. It must from its very nature be advisory, but its advice is so publicly known that it can hardly be turned down unless there is a desire to precipitate a quarrel.

The course of shop committees however seems to be rather uncertain. When they are first formed, there is considerable enthusiasm. After a little time they may turn in several directions; they may resolve themselves into grievance committees and, after they have achieved all that is reasonable, may begin to be captious and stick at very small points. The management gets impatient at their narrow point of view and abolishes them entirely. Or they may become political and men may resort to the same methods used in ward politics to secure nomination and membership in the committee, and then they may secure advantages by impressing their constituents with the value of what they have done. In any case, the members of the shop committee are not in an enviable position, as they have to compromise among themselves and with the management in order to accomplish any good at all, and then they have to explain to the workmen how it happens that they have not accomplished what was desired.

Some committees have been formed with the express restriction that they shall not discuss wages and hours, but shall act for the purpose of promoting athletics or entertainments or aiding the sick or for some purpose not always uppermost in the minds of the employes. However, to form a committee with such restrictions is unwise, because no power whatever can prevent them from considering these things, and if no attention is

paid to their requests, the management is deemed antagonistic to them and to the employes. The one thing that cannot be barred is discussion of wages. To try to prevent it is comparable to gathering the sales department for a conference and trying not to mention prices.

Methods of Selecting Committees

The method of selection of representatives on committees varies in different concerns. In some, the workmen all assemble without any of the management present and vote for their representatives in open meeting, very much like a town meeting; in others they vote by the Australian ballot and each man's vote is a complete secret unless he sees fit to announce it. In some cases the whole shop will vote for delegates at large, and in others each room or department will vote for an allotted number of representatives. In some cases the representatives who form the council that deals with the management are elected directly by the workmen, in others the body which is elected by the workmen elects still another body; and in some cases this last-mentioned body elects a very small executive committee which handles nearly all matters without referring them back to the larger committee. In one shop, the final executive committee meets by itself and sends resolutions to the management, in another the executive committee is met by an equal number of persons selected by the management and a joint meeting is held, the votes of which are considered by the management then and there. Every possible combination of these elements is in process of being tried out somewhere. The whole system of shop committees is in process of development, and only experience can show what methods of dealing with them are best.

From the employe's point of view the secret ballot in connection with the election and operation of shop committees is undoubtedly very necessary. Some men resent having even so much restriction put on them, and declare that any one who is not man enough to vote where every one can see what he is doing should not vote at all. Nevertheless, the secret ballot undoubtedly cuts down the amount of time spent in electioneering about the shop, with the attendant loss of production for some days or weeks prior to the election.

It is sometimes difficult to get suitable representation of different parts of the shop with a small committee. For example, in a small shop there may be a large number of woodworkers and a small number of yard men, machinists in the repair

shop, blacksmiths, rubber workers, coopers, and so on. The work of all these men is necessary, their trades are quite different from the woodworkers, and it is practically impossible to get a truly representative committee unless there are enough members so that the trade having the smallest number of employes has one representative and each other trade has representatives in proportion to its numbers. An expedient that has been used is to elect this large committee and then for that committee to elect, from its own number in some cases and in others without restriction, a smaller committee which is intended to represent the whole shop. This plan has the difficulty that the smaller committee may very likely have on it no representatives of the trades that have but few employes.

It is not at all easy for a woodworker to understand the troubles of a blacksmith nor to see why he needs suitable equipment nor to understand what is suitable. This same lack of understanding is likely to be found wherever the shop contains a minority of highly skilled workmen whose work is, however, essential to the continuation of the work of the majority. The shop committee in such a case transfers the need of an understanding from the employer to the shop committee. Experience so far indicates less tolerance on the part of one body of workmen for another than that existing on the part of employers toward these same men. The best that can be done seems to be to insist that at least one representative of one of the minority trades be on every committee that sits with the management. Of course insistence by the management on the make-up of committees does not make for a pure democracy, but that perhaps is not of great importance.

In the deliberations of the large committee elected by the workmen themselves, it does not appear that the management is even represented, in many cases, though they are expected to provide the room, the time, and the equipment. This is undoubtedly a wise provision; for if nominations are made from the floor there will undoubtedly be many speeches made that would be enlightening to the management, but which would not make for further good relations. The executive committee, when there is one, is very likely to have its principal deliberations in private and to appear in meetings with the management only after the committee have united on a policy which is as it should be for the good of both parties.

The test of time alone will tell to just what extent the whole number of employes care about this representation by committee. In the meantime it appears wise, though it is not often

mentioned, to insist that a majority constitute a quorum and that no vote by a smaller number shall be considered carried. It is customary, also, to make a certain length of service a qualification both for voting and for holding office. The length of time in the company's employ to entitle an employe to vote is placed all the way from one month to a year, while the employes who hold office must have been in the company's employ from 6 months to 2 years. It seems reasonable to let employes vote for their representatives as soon as it seems likely that they intend to remain, and that the officers should be chosen from among men who have been with the company long enough so that they are well acquainted with its methods, which is seldom less than a year. It has been suggested, but not so far put into effect, that every new employe should pass over one election after he is hired before he is allowed to vote. This is suggested as a means to prevent important offices from being filled with the friends of some group of men who do not intend to stay and who may possibly not even have severed their connections with the firm for which they worked before.

Perhaps the things most to be feared in connection with committees are a total loss of interest on the part of the employes who might be of the greatest assistance to the firm, and the danger that men will be elected as representatives on account of their social qualities rather than because of their ability to represent truly the men who elect them. Dangers of this kind, however, are diminishing in modern industry.

Design of Product

If the company is a one-man concern there is no doubt as to the man who shall control the designs; it is the one man, of course. If, however, the company is made up of men who are practically in partnership, there is danger of friction over the designing. If the company is virtually in the hands of its general manager with an absent board of directors who are only interested in dividends, another set of influences may determine the work of the designing department.

The question of who should control designs depends, likewise, a great deal on the nature of the product. If it is wallpaper or automobile bodies, it may be that the sales department may properly have the greatest say, because sales depend on suiting the taste of that part of the public that is being catered to; but if the product is automobile engines, electric motors, or machine tools, the engineering department should

have the say, subject to consideration of the manufacturing difficulties which the shop may discover on inspection of the drawings. In all these cases, it is vital to remember that the product must be sold as well as manufactured, and that sales may sometimes be more easily made by making production costs higher. If "talking points" will save the company more than they cost, then they are certainly worth while. For example, in almost every new product there is an evolution from incompleteness to completeness. The automobile and the phonograph began with comparatively simple things that were very incomplete from our point of view today. The automobile of twenty years ago needed head and tail lights, horn, wind shield, and other devices. These all cost more to produce than they might without certain refinements, but the customer gladly pays the bill, for he now knows that when he has bought any of these things he has something complete, and that he will not have repeatedly to go down in his pocket for necessary extras.

Questions in regard to such things are properly determined by the sales department; for that department is in touch with the customer and knows whether the public will pay enough more for all these extras to make it profitable to furnish them, or whether such things will enable the sales force to make sales for enough less cost so that they will be profitable, or, in other cases, whether the fact that some competitor offers a complete machine ready for use has made it necessary to make a similar offer with little regard to whether it is more profitable or not.

Design as Related to Production

From a purely production point of view, differences in design may make very considerable differences in cost. As a general rule, the designing department is likely to look out for things that do not so much appeal to either the sales or the production department as to engineering. Perfection of mechanical operation of machinery is a natural thing for an engineer to place above cost or selling points. In some important manufactures it is the most important. If the product is scientific instruments, then mechanical perfection is everything. If it is wheelbarrows, then it is best to let well enough alone, for added mechanical perfection will not be appreciated nor paid for.

Certain things however are strictly in the province of the drafting room or engineering department, for, within the limitations specified by the sales department and the production department, they still have the problem of designing parts so

that they can be readily made and equally readily assembled and disassembled. The ease of production of parts is likely to receive much the greater attention, more than it really deserves; for money spent on the erecting floor adds to the cost just as does money spent in preliminary operations.

Design of Parts

A concern that makes nothing but steel wire nails has no problem of design, because it cannot depart from established standards of the trade. A concern that is building machine tools is under the necessity of making its machinery sufficiently distinctive so that it will not be scornfully referred to as a copy of some other manufacturer's machine. Manufacturers of automobiles must make their cars sufficiently different from all others so that they may be instantly recognized from some distance, for advertising purposes. Yet in all these cases there are considerations of design that can make the difference between a profit and a loss. In the case of wire nails, the very slightest difference in the shape of the head may have a considerable influence on the length of time the dies will wear or on the ease with which they let go after the head is upset. In the machine tool, there are numerous parts that perform important functions, but which are never seen by the purchaser unless in case of a breakdown. In the automobile, the same holds true. So far as these things are concerned, then, the engineering department should, after providing for strength and mechanical perfection of the degree needed for successful use, consult the shop as to the form and material of details that will make manufacture economical.

For example, consider the use of standard parts. If, in the case of an automobile, it is possible to buy all nuts, bolts, screws, and washers from standard stock, there is not only a saving for the manufacturer, but there is a great convenience to the purchaser. The idea that it should be made necessary for a purchaser to send to the factory for trivial repair parts has been shown to be erroneous. A cabinet-maker who specifies sizes of glass a trifle larger than standard sizes makes his firm pay for the next larger size with no salvage. Tubing can be obtained in so many sizes and thicknesses of wall, that it should not be necessary to create new sizes; and yet special sizes are being called for all the time.

Within the shop itself, standardization is not only possible but profitable. If, for example, the company manufactures a

line of woodworking machinery, it is possible to use the same parts on different sizes of machines. The parts may be unnecessarily heavy and strong for the smaller machine, but the labor cost is so much reduced by making lots twice as large that the difference in cost of material is much more than made up. A manufacturer of engine lathes can use aprons of the same size on both an 18-inch and a 20-inch lathe, and the same on a 14-inch and a 16-inch, and make a profit by so doing. There is especial advantage in using as many gears of the same size as possible, for a very considerable gain comes from so doing. Also, parts of the same kind that can be made to advantage on a screw machine or a turret lathe should be used on as many machines as conditions permit, for the reason that the cost of screw-machine products decreases rapidly as the lots are made larger and the cost of setting up the machine is distributed over a larger number of similar parts.

Selecting Materials

Selection of materials is also of great importance. In making machinery it is often the case that ordinary soft steel is amply strong and otherwise fit for the purpose, but that it will pay to buy a higher grade of steel for the sake of the greater ease of machining. For example, if the part has screw threads, it is wise to use steel of at least 25 to 30 points carbon (that is, .25 to .30 of 1 per cent.), as the tools last longer, and they do not require to be kept to as keen an edge as is necessary in order not to tear the material and spoil the job if low-grade steel is used. If the work is straight, like rollers or shafts, and it is to be ground for the final finish, there is no great difficulty in using the low-grade steel; but if the work has any outlines that must be formed to a curve or if screw threads or channels are to be made, it is profitable to use the harder stock, as it can be finished well with ordinary cutting tools. Such instances multiply and make necessary the careful study of materials in the engineering department, a thing that often is not done. It is even true that parts ordinarily made from castings can often be more cheaply made on the screw machine from cold-rolled stock. Castings themselves can be annealed, and thus a great deal of cost of machining will be saved as well as cost of tools used and worn out. Also the internal stresses in the castings will be eliminated. The practice of annealing is, however, confined almost entirely to shops like those of manufacturers of textile machinery which have great numbers of small parts that

can be annealed at once. However, an annealing furnace is not expensive and in these days of gas requires little attention.

Design for Easy Machining

Particularly in the manufacture of machinery, there is great possibility of saving money by adapting the parts to easy machining. There should be a constant balancing of the advantage of making parts in one piece and of making them separately and fastening them together. If parts are made in one piece, alinements that are necessary are guaranteed except for wear. However, it may be very much cheaper to make them in separate parts and bolt them together. If, when bolted up and sufficiently dowelled, they cannot be disturbed so far as alinement is concerned, then it is surely wise to make them that way, unless the appearance of the product is against it. Some designers seem to have a mania for making their machines, as they say, "in the foundry," casting as much in one piece as possible. This is not only expensive in the foundry, but it often may make the total cost very high, indeed.

Design for Long Life

Certain manufactured products are articles of consumption and are not efficient unless used up, as, for example, grinding wheels, milling cutters, and similar articles. Long life in such a case means simply life as related to effective working. It is always wise to buy grinding wheels that will cut freely, rather than those that merely glaze over and yet last a long time. With milling cutters, long life means retention of a fine cutting edge for a considerable time. On the other hand, steam engines are ordinarily used for many years. They require expensive foundations, and the installation expenses are heavy. Consequently, they are designed to last for as long a time as possible. The cylinders are made heavy enough so that they can be rebored several times without becoming weak. The various bearings are all made with provisions for wear. To be sure, the recent advances in the manufacture of steam turbines have caused the stopping of many reciprocating engines that were designed to run for a long time to come, but that is one of the freaks of progress that should always be expected, but which seldom come. Textile machinery affords an excellent example of temporary design, as does also enevelope and box machinery, and, to a lesser extent, printing machines. All of these have a history of constant advance, so much so that a machine ten years old is pretty well discounted by the machines that have been

put on the market since. Consequently there is not much reason for assuming that the future will be different from the past, and it hardly pays to put more money into such machines than at present. The result is that looms and other textile machines are crude in appearance and workmanship as compared with some other kinds of machinery. However, they fulfill their need, they last until something better is invented and placed on the market, and consequently there is no good reason for discarding them for lack of refinement or for making them any more expensive for the sake of longer life.

Printing presses have to be much more accurate in their movements than do textile machines, and yet they are not of the extreme refinement that is expected of precision machine tools or telescope mountings and the like. The latter, perhaps, represent the extreme of refinement, high cost, and long life. It is not expected that a telescope and its mountings will ever be entirely discarded or rebuilt. When a new and larger telescope is built the old one is still kept in commission and used for such work as it can do well.

Lasting Designs

A notable example of the use of a design without change is the Ford car. Where other manufacturers have brought out a new model every year, Ford has clung to the same car, and with the exception of a slightly less offensive style of hood and a few other minor changes it is the same as when it first began to acquire nicknames. There are many other kinds of machinery, notably in the machine-tool field, that have maintained a place on the market for even longer periods without change of design, but they have not been so much in the public eye.

The requisite for keeping on sale without change is a mingling of conservatism with being ahead of the times, and with an entirely definite honesty of design and materials that is seldom possible. In the march of progress, there are always certain underlying principles that must be taken into account by the designer. If the machine is designed according to these principles and it does not break down and give trouble, it is almost certain to find some sale at all times. But, besides the qualities mentioned, it must in some way be ahead of the times when it is launched. If the principles are good, however, it is possible to sell things which are ahead of the times. When the Ford car was brought out, the public were still accustomed to see the old style of Oldsmobile with the little curved dash that

reminded one of the still older-fashioned ice skates. The Oldsmobile, however, paved the way for a car which had the engine under a hood in front, instead of a single-cylinder engine under the seat, and also for a four-cylinder engine, which at that time was comparatively new but was sufficiently tried so that its success was certain. The use of these innovations by Ford was enough to place his car ahead of the times, but not sufficiently so but that the builder could keep up with his orders. Later, after other low-price cars outstripped his in appearance and comfortable riding, the fact of its dependability came to be an important thing. Exactly similar things have made it possible to continue certain machine tools on the market for twenty years with very little change. First, there has been a distinct advance over current practice, then an up-hill period during which sales have been hard to make, but satisfactory. Then a period during which competitors have perhaps created better designs, but have not maintained the quality of workmanship or material that has been held to by the original maker.

Design for Quick Delivery

Certain products may be produced rapidly in emergencies, but there may not be sufficient margin of profit in them to justify the carrying of large stocks, or the prevailing styles may be likely to change over night. For example, farm machinery is not likely to be ordered by the consumer until needed. He has no very great amount of loose capital, in fact he very likely has to go to his bank and discount his note to get the cash at all. He wants the machine delivered at once. Consequently, while agricultural implement factories run the year around, they run the fastest when the demand is greatest. The latter statement is true of things that are subject to changes in fashions, like clothing, hats, and so on.

In many cases the designer cannot change styles, but he can often meet the needs by designing methods of rapid production. The World War gave a wonderful opportunity for the doing of just this thing. Where previously it was expected that somewhere around three years would be given to designing and making tools and fixtures for any but the simplest product, during the war it was found possible to use machines such as flat turret lathes to do a great deal of effective interchangeable work that would ordinarily be put on automatic screw machines, and also to do a great deal of milling-machine and planer work without waiting for expensive jigs and fixtures, by making changes

in the design which made it easier to hold the castings which were to be machined.

General Considerations in Design of Product

Because there are so many things to be thought of when designing machinery or any manufactured product that is open to variation, design should not be the function of one of the major departments alone. As a rule, a draftsman, or designer, is more likely to have the purely mechanical use of the finished product in his mind than any other, and he is consequently, likely to resent what he deems interference, if the other departments take a hand in his results or if they ask pointed questions. The only way to avoid ill-feeling over designs is to secure draftsmen who realize that for their own good they should seek out all the information possible before they are asked to take advice. It seems natural for one to wish to get the benefit of all available experience, but there are many draftsmen who fear that their standing in the eyes of the management will be lowered if they admit that there is any one in the employ of the firm who is capable of giving them any help. In such cases, criticism by a committee is likely to work out well, because then there is not so much chance to become personal.

Equipment

In former times whenever the owner of the shop was a graduate of the same kind of shop and knew from personal contact just what could be done on every machine that was offered, he did not need to consult other people so much, while as a matter of fact he did consult them more. He was so bubbling over with enthusiasm about his business that he could not help talking it over in detail with his older and more trusted workmen. Even some of the most hard-shelled of the old school of business men were most prone to have their confidants in the shop. They may never have directly asked for advice, but they at least gave their employes a chance to express their views.

The available equipment for standardized industries is becoming more and more specialized. However, as a machine becomes more rapid in its action, and its output the greater, the longer is the time usually required for setting it up and preparing the work for it. The shop, if it has a sufficient supply of capital, has the choice of whether it will manufacture all its product in large lots to enable it to make the parts at their lowest possible cost, and store them away against the time when

they will be needed, or whether it will manufacture in more nearly a hand-to-mouth manner and save the interest, insurance, and storage charges. This large decision must of course be made by the management.

If the design of the product has been made on the basis of a long run without change of design, and the firm can depend on itself not to make every improvement that it happens to think of, then it becomes a matter of balancing interest, storage charges, and insurance on partially completed product, against saving in labor cost. Almost every job that can be done on an automatic machine has its minimum number that can be done profitably. The ideal situation is where every machine of that kind is kept permanently running on one thing, year in and year out. Such conditions are rare, however, as compared with the great quantity of work being done all over the world on a hand-to-mouth basis. Such things as the "dollar watch" which helped make the name of Ingersoll so well known, or the Ford car already referred to, justify specialization in machinery to the very last attainable degree. Other just as necessary articles, however, must of necessity follow the changing desires of the purchasers, and will require for their manufacture a much less specialized equipment. Again, and especially in woodworking and machine-shop practice, a special machine has no value that justifies it as a basis for credit at a bank, while the ordinary machine tools and standard woodworking machinery have a tangible and usually pretty well defined value and a ready sale. Thus, while the shop organization may be presumed to have the best working knowledge of the equipment needed, the treasurer needs to have a complete understanding with the shop organization as to the capital available and the dangers incurred in sinking too much of it in nonsalable equipment.

Jigs and Fixtures

Whether jigs and fixtures should be determined on by the engineering department or whether the latter should merely make the necessary drawings for their construction under the direction of the shop, is a question which has been debated many times and which often seems to depend on the personal qualifications of the men in charge of the two departments.

The design of jigs and fixtures, if it is decided to use them, is very distinctly an engineering problem, but one on which the advice of workmen may very well be sought. The question of how far they will be used is, like the question of equipment, one

in which the capital available, the length of time a design is expected to be used, and the accuracy and interchangeability of the work, enter. The management alone can determine how much capital can be spared. It should be borne in mind that jigs and fixtures are practically a complete loss except to a going concern, and that a slight change of design may make them a complete loss even then. Moreover, they cannot well be altered to meet even slight changes in design, for they need to be preserved to take care of the repairs that are likely to be necessary to machines made when the old design was in vogue. There is a rule of practice often used to the effect that no special fixtures or jigs should be made unless they will save their cost in a year's time. Such a rule is unsafe, because in some kinds of manufacture a jig that saved its cost in five years would be perfectly justifiable, but that is only in a case where permanence of design is well established.

After it is decided to make a fixture for holding any one piece of work, say, for example, on the milling machine, the engineering department naturally makes the drawings; in some instances it may be well for the design to be accepted and the fixture made as designed, but in many other cases it is best to let every one who is likely to have the job look it over. For example, a large casting weighing 400 or 500 pounds is placed in a fixture weighing 1,000 pounds. If this is left without easy and obvious means for handling it on and off the machine or for turning it over if the piece requires it, then the fixture will be a constant source of unnecessary expense; while if it is provided with a pair of trunnions and a spreader for crane chains, it can be moved and turned over at almost no expense at all. Even in the case of the very smallest of jigs for drilling simple holes, there is likely to be opportunity for men who are constantly using them to give good suggestions. Very often in going through a shop men will be noticed using rigging of their own in addition to the jig that is intended to do the work. It may be a drilling jig and they may have to use a monkey wrench to hold it so that if the drill catches when breaking through they will not hurt their hands. This is a matter to be considered not only by the designer of the jig but also by the safety engineering department.

HANDLING MATERIALS

Machinery for Handling Materials

In a watch factory, the problem of handling material in process about the shop is very small. If locomotives are to be manufactured, the problem becomes more important, but the solution is simple and is practically the same in all shops. Between these two extremes, there is a great range of shops where the handling problems have by no means been solved and where many more laborers are used than should be. At the very entrance to most shops it is common to find the unloading of coal and other supplies bungled, merely because at one time the wages of laborers were so low that it did not seem worth while to furnish a substitute for them. The actual handling of materials in process is, of course, strictly a shop job and must be done as rapidly as production progresses, with whatever facilities are afforded by the company, no matter how inefficiently it is done. The total cost of handling may be very small or very large, according to the nature of the business. If it is a large problem, it is usually well handled, but the shop in which it is a minor item is likely to waste much of the money which it does spend for this purpose.

When these cases are analyzed, it is often found that the trouble is that the firm feels that proper handling devices will cost more than they will earn. This may be entirely true in some cases; but there is such a supply of expensive handling machines on the market that it is not always easy to remember that there are simple, inexpensive, and adequate means for expediting much of the work. Oftentimes a roller gravity conveyer that can be moved from place to place will save its cost in a few days. Where machines are arranged in rows and parts have to go from machine to machine for succeeding operations, these gravity conveyers do the work, and at the same time make it easier for the operator than it is for him to pick up the part from the floor or a truck and then set it down again after the operation has been performed. Inexpensive overhead trolleys save a great deal of floor space that would be required to keep open paths for trucks. Belt conveyers will carry the things up which have previously been sent down the gravity conveyers. The ordinary and much abused wooden rollers for moving machinery in emergencies can easily be made much more efficient if the men who use them would only learn the principles on which they operate. It is painful to see a gang of half a dozen men tugging away to get a machine around a corner when the machine would have rolled

around with only two men to push it if the rollers had been "cut" properly. All of these things are very inexpensive compared with overhead cranes, Brownhoists, and such things. They do not take the place of the latter, but they do many things that need to be done, just as quickly and well as much more expensive installations.

The planning department is perhaps in the best position to discover these little ways in which production can be expedited, and on it will fall the burden if things do not move easily from machine to machine.

Even when the most expensive or the most efficient handling machinery is provided, there is always some work around the shop or yard which requires manual labor. Coal, if it comes in gondolas, must be shoveled over the side unless there is a hoist with a grab bucket to take out the most of it. Even then there is some hand work necessary. Very few shops are so situated that they can dig their foundation places by other than hand power. Some are fortunate enough to have an open gravel or other easily dug land and can do it all with steam shovel, but there are always emergency jobs not large enough for the use of a steam shovel, and which must be done by sheer strength. Therefore, there will always be need of a yard gang in every plant of even very moderate size.

The yard force and all the helpers in the shop engaged in handling materials in process are usually under the shop superintendent, he being the one in the best position to keep them under supervision, but their work most vitally affects the work of the planning department. The remaining laborers who attend to the cleaning of the shop are also usually under the supervision of the superintendent, but in some cases a separate janitor force is maintained, which may, on account of the care of the sanitary arrangements, be placed under the care of the medical department. However, the latter department is seldom in a position and hardly ever cares to assume the responsibility for work so distantly related to its own work, so all that the medical department does is to make a monthly inspection of all locker rooms and toilets.

Yard Switching

If the plant is on a railroad and has switch connections in the yard, there is usually a pretty definite arrangement with the railroad by which the company keeps things clear and makes such repairs as the railroad may demand or else it loses its service. The tracks in the yard belong to the company on whose

land they are laid, but it has merely physical ownership of the rails and ties. The railroad is in entire control, otherwise it will not risk its engines and cars on them. When there is use of the tracks inside the yard by the owner's engines and cars, these special cars or locomotive hoists should not go outside the yard limits onto tracks which may at any time be used by the railroad company. It is very desirable at times to have a light switching engine that can be used to move cars once set in the yard. A locomotive crane can be used for this purpose when not needed for its regular work, but such use is not economical when there is any other work for the crane, as it is not only an expensive machine but is very slow.

Yard Trucking

Trucking within the plant itself is very often necessary, and the horse-drawn truck for short hauls has by no means been proved inefficient. Long-distance trucking, where the traveling time exceeds the loading and unloading time, is probably cheaper by motor truck than by horses. If the yard is well paved with sheet paving and the loads are light, the low-wheel electric truck is probably best, not so much because of any cheapness in first cost or operating cost, but because of the fact that these little electric trucks can go on elevators and can take a load from a machine on one floor of a building and deliver it on another floor of another building without having to transfer the load at all, while with the horse-drawn truck it will have to be transferred twice. The relative costs of the different methods of trucking at any time and in any plant can be computed by taking into account the cost of horses, feed, and care and repair of trucks, as against cost of storage-battery charging, decreased cost of labor for loading and unloading, extra depreciation and repair of electric trucks, and the saving in space due to the narrow passageways required for electric trucks, which can make very sharp turns.

As a rule, the work of electric trucks neither overlaps that of the overhead traveling crane nor takes its place. The crane as has already been explained, is a great saver of floor space, saving on an average at least five per cent. The electric truck is useful to bring things to the crane and to take them away, for which purpose demountable bodies or boxes that can be hoisted by light chains at the corners are desirable, both to make easy attachment and to make a respectable load for the crane instead of its having to make several trips for small loads.

Traveling cranes are a matter of necessity for certain work,

and the border-line cases in which it is difficult to determine whether they are a necessity or not are few, but in those few cases the virtual addition of floor space resulting from the use of cranes is worthy of consideration.

Special Trucks and Stands

Parts of machinery in process, that cannot be rolled from machine to machine, are advantageously handled by means of special trucks, such as shown in Fig. 12, which is a sectional view of a truck for handling spindles and shafts or automobile crank-shafts, or that shown in Fig. 13, which is used by a manufacturer of sensitive drilling ma-

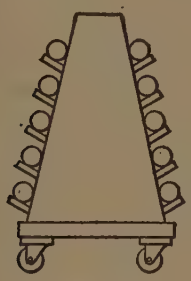

Fig. 12

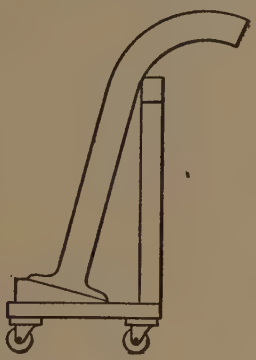

Fig. 13

chines. These trucks are mounted on substantial castors so that they can be readily rolled from place to place. They serve both to keep finished work from being scratched, and to keep it in shape for orderly movement about the shop.

METHODS OF ROUTING WORK

Development of Routing Methods

Methods of manufacture can be classified as *straightaway* methods, in which the product goes in one direction all the time; and *assembly* methods, which may need the services of a planning department, as will be explained later.

Examples of straightaway methods are the manufacture of flour, of paper, wire, and so on, which require certain very definite methods that have already been standardized, but which are and have been subject to great improvement by means of automatic machinery. Thus, in the manufacture of rods from billets in the steel mill by the use of the continuous mill, the work can be made entirely automatic, even to cutting off the rod while it is still running at full speed. The processes are identical in prin-

ciple with those of the earliest rolling mills, but the present-day machine does not look at all like the older types. Such manufacture becomes almost automatic in the hands of the men who have to attend to the transfers of material from one machine to another. When a man has trundled bundles of wire down a certain passageway for years, there is little need of a planning department to tell him to keep on trundling it so long as the supply lasts. The slack between machines, of which there must be some, is automatically taken up by the men, since men of the type that will work at jobs of this kind are not inclined to do more than the circumstances dictate.

The greatest amount of inventive energy has been spent, in the past, on continuous or automatic production, and the greatest engineering feats have been performed in the attempt to reduce the human element to its lowest possible terms. This is entirely natural, as it is easier to measure the work of the engineer in such products than in general manufacture. Steel-mill product is simply weighed, and the tonnage is the basis for all computations. The grade is established by the analysis of the product, and every effort is put into rapidity of production. This is so readily measured that any change in methods of manufacture can be noted in the weight of the daily product almost at once, and it is so far independent of the human element that it is a really correct basis on which to rate the engineer who puts in the new system.

Where, however, the human element in production is in the ascendency, the effectiveness of an engineer's plan cannot be so easily rated. For example, in a machine shop, it is always possible for a man who is well trained and who wishes to make a good record, to do anywhere from 50 to 200 per cent. more work than is customary in the average shop, using the same machinery and tools. And yet it is difficult for any one to say that men in these shops are actually loafing. They are busy visibly, but their minds are not on their work or they have not the mind to accomplish the results that they might. There is a very good example of this to be found anywhere that piece-work rates are given and the workmen do not fear a cut in them. There is seldom any flourish or evident haste in a piece-work shop. Every one starts the day at a pace he knows he can maintain; lost motion is eliminated by experience; and, while the men may not take the best method of doing the work, if left to themselves they perfect themselves in their own method so that they can readily and without undue fatigue turn out a great deal more work.

Under such circumstances, the promoter of new and more efficient machinery is dependent on the human element to prove its value to a much greater extent than if his machinery were for some one of the continuous processes. He may find, when he put his new machine in the shop, that the piece workers have perfected their own methods so thoroughly that his own expert cannot do as much with his improved machine as they are already doing with their old machines and crude ways. On the other hand, he may provide himself with experts to demonstrate his machine and find, when it is placed in a shop where the work is all on day rates, that the men use his machine with so little energy that it proves a disappointment to the managemen and he is requested to take it out, regardless of the fact that his own men can make it a very profitable investment. This very fact, that the management becomes practically helpless in the hands of its employes under the old systems of management, has led to various interpositions of departments between various parts of the shops.

Reservoirs

In continuous manufacture, the product of one part of the process is transferred to another process, and one of these processes may proceed more rapidly than the other. It is not always possible to take up the slack between them, even within one machine. A notable example of this is found in the progress made in rolling wire rods. The earliest process required the passage of the billet through a pair of rolls. It was then handed back by manual labor to the side of the rolls from which started and passed through again. As it grew smaller, it cooled very rapidly and had to be reheated. The next step was to make a "three-high" mill and send the rod back between the two upper rolls and then through again between the lower pair, since the central roll turned steadily in one direction and therefore the upper and the lower rolls turned in opposite directions. This was a great improvement, but it required considerable manual labor of a highly skilled nature, and the two ends of the rod were unequally cooled. The end which came through first was the last to go back, and consequently it was impossible to get the rod of equal diameter its whole length. Then some one conceived what is known as the Belgian mill, which consists of a series of three-high mills through which the rod is led so that it forms in loops on the iron floor of the shop. These loops grow larger or smaller according as the number of passes through the various rolls is well or poorly balanced. Then American inven-

tors evolved the continuous mill, which is simply a series of two-high rolls placed close together, and with passes that are closely designed so that there is no slack between one roll and another and so geared together positively that the increased length of the rod is taken up by equally increased speed of the rolls. In this machine, not merely does the wire rod not cool off, but it will actually increase in temperature, as a blacksmith used to illustrate by hammering a nail rod until it became red hot from his blows.

In this evolution of the rolling mill is illustrated exactly what has happened in many other cases. First, there was no effort to make rapidity of production anything but a personal matter. Then there was the introduction of a process that assured rapidity of production by the speed of the rolls that completed the product, and there was a reservoir, in the form of the loops of rod on the floor, to take care that no back tension was put on the rod in its later passes; then, last, the tuning of the machine so well that even when delivering rod at the rate of a mile a minute there would be no slack, but every part of the machine would be working at top efficiency.

So the first move in establishing efficient production is to locate reservoirs into which one process or series of processes empties its product, which in turn becomes raw material for the next step. The size of reservoir necessary is a measure of the efficiency of the shop, except in certain instances, as it exhibits to the eyes of the management material and labor tied up which should be in process and getting toward the point of salability.

Of course there are manufactured goods whose excellence is dependent on the action of time on the materials. Furniture made of green wood, varnished with quick-drying varnish and only half-rubbed down, is not good furniture, leather not left in the tanning vats long enough is not good leather, but these should be looked on as material in actual process, of drying or rubbing or tanning, and not as material in a reservoir waiting for a chance to be put through another process.

When a shop grows to the point where one man cannot longer carry in his head everything connected with the shop, or when the old superintendent who could do it by virtue of having learned it little by little, leaves or dies, then it becomes necessary to install some form of control that will make it possible to complete whatever is made, without resorting to the emergency manufacture of several small parts which have been overlooked. Firms are always reluctant to put in anything like a

planning department, because it is expensive. No group of men of sufficient ability to handle a number of reservoirs of work can be hired for what a single superintendent will do his work for. Consequently, the planning department is never installed except as a last resort, or because some one in the organization realizes that it will have to be resorted to and does not wait for the emergency actually to arise.

A reservoir in its simplest form may consist of a man and a chalk mark on the floor. This chalk mark surrounds the man and encircles a neutral zone between two departments. All the finished product of the first department is delivered to the man inside the chalked enclosure and is receipted for by him. He in turn delivers it to the next department or departments, if he is at a dividing point, but only so fast as they can absorb it. This very simple reservoir, however, is expensive, as the man in charge must for his own protection know exactly what he receives and what he delivers and to whom. He must count pieces or weigh them, as his reports show the production of the preceding department and serve as check on the succeeding department and its records. Under a single superintendent this was seldom done. Each department made its lots large enough to allow for some spoiled work, and no one knew or cared where it was spoiled, whether in the last operation, where all the work so far done was lost, or in the early stages where little but the material was lost. The superintendent did undoubtedly know pretty well where to place the blame if the allowed loss was exceeded, but he did not know where to give the credit if it was not exceeded.

It is nearly always well to combine the efforts of the planning and the inspection departments, though this practice is by no means universal; for it is important at each stage, not only to know how many parts or tons of material go through, but to sidetrack imperfect work so that more work shall not be thrown away upon it. It is human nature not to report spoiled work, but to see if it will not slip by and be credited, or to hope that the loss will be charged to some one else.

Value of a Reservoir System

The gains from a reservoir system are, however, great, and greatly exceed the cost, though they cannot always be measured in money. If the material in transit between departments is actually moved into the space reserved for the keeper and the inspector, it gives visual evidence of the slack in the organization, just as in the Belgian rolling mill the size of the loops of

rod on the floor indicates the extent to which the different rolls fail to coordinate. If, however, the materials are kept at some other place, the records of the planning department must be depended on to show the conditions. Some superintendents are more impressed by actual castings and unfinished parts while others are impressed by figures. Inasmuch as these parts occupy the same amount of room wherever they are, it is apparently only a question of whether the floor space shall be closely covered with the machinery and the planning department have a clear floor space for its work, or whether the machinery shall be more widely spaced and the material be left beside the machine on which the last operation was performed until it is inspected and the next department is ready for it. The extra cost of dividing the transportation of the material into two steps, one from the machine on which the work was last done to the reservoir, and the second from there to the next department, can be made negligible by the use of trucks with removable bodies so that the individual parts are not taken off the truck bodies while they are in storage. In making the trucks for carrying the parts, provision should be made for ease of inspection.

The reservoir system is applicable to the manufacture of goods that follow a fairly definite onward march through the shop, but which may have branches from the main line for special purposes. The manufacture of grinding wheels furnishes an example. Here the work goes forward in several parallel lines according to the kind of wheel being made. The vitrified wheel, which is the most used, goes through the processes of weighing out the grain and the bond, mixing, pouring into molds, air drying, shaving roughly to shape, burning in the kiln, truing, bushing, balancing, and testing. These are the rough steps; of course there are many subdivisions possible for each. For the sake of expediting the work, dams may be thrown across the path to form reservoirs as follows:

Weighing out
Mixing
Pouring
Air drying
Shaving
} Burning Truing { Bushing / Balancing / Testing

Reservoirs are not possible between the operations in the first column because the movements from one operation to the other are dependent on the condition of the wheel. For example, the time which a wheel remains in the dry rooms depends on its thickness more than on any one other element, as if too

wet when removed it will crush of its own weight and if too dry it will crumble during the operation. Reservoirs could be put between the operations in the last column, but do not need to be, because each shop has some definite rule of its own as to how small wheels are to be before they cease to be bushed, balanced, or tested. For example, little wheels for dental use are not bushed, balanced, or tested, while a 4-inch wheel for a cutter grinder may be bushed and tested but not balanced, and all wheels over some definite size, say 8 inches, are subjected to all three operations.

A reservoir just before the burning operation enables rush orders to secure right of way, even though they are not for the wheels which the kiln loaders would like to use to fill out their kilns. And it makes it possible to see that a proper number of stock wheels are put in, though the demand may have changed during the time which has elapsed since the wheels were first mixed.

The burning process likewise requires a considerable length of time, during which stocks may have changed so much that another revision of requirements may be desirable after burning, so that certain wheels may be rushed ahead of others which have not sold so well; therefore, a reservoir after the burning enables the rush orders, which have been burned in the smaller kilns again to be given right of way, and makes it possible to insist that they get it. As with most other products, there are desirable jobs and undesirable ones. If the work is left to the workmen, the undesirable jobs will be allowed to lie on the trucks and the "soft," or easy, wheels will be pushed along, even though they are not needed. If the choice is left to the foreman, it is likely that the good jobs will be given to the best men, the ones whom he cares most about keeping, and the more difficult wheels will be left to the men for whom he cares less. That is, the work is likely to be distributed in reverse proportion to the ability of the workmen. A continuous flow of the work which is of most consequence in the filling of orders can be insured by reservoirs properly located.

Development of the Reservoir System

Whenever a branch is found in manufacture, consideration should be given to a reservoir and a means for diversion of the proper materials to the branch. For example, in the manufacture of envelopes, they may all be cut in a single cutting room, but some of them do not require printing, some do not require gumming, most of them are folded by machinery, but a few

are folded by hand. Therefore, after the blanks are cut they must be distributed by some one who knows the necessities and the promises of delivery that have been made.

Even in the manufacture of wire, which is usually given as an example of continuous manufacture, there are specialties. Some wire is tinned, some is galvanized, flat wire is rolled and not drawn like round wire, there are various special cross-sections to be made, and a spring department and a wire-nail department are very natural adjuncts. All of these diversions from the regular course require reservoirs which can control the flow of product from one department to perhaps a dozen others.

Development of a Planning Department

A shop with two or three reservoirs like those described can place men of intelligence and good cooperating power in charge of them without any central head and be very successful, as each of such men will respond to calls from the others and will make suitable compromises between the needs of the sales department and the most efficient working of the shop. However, the moment when for any reason there is not perfect coordination between the men in charge of each of these stations, there is need of a central department to issue instructions which these men will carry out. If this central department, usually called the planning department, is made by calling into the central office the men who, as managers of the reservoirs, have done the individual planning, it is possible to man the actual reservoirs with men who are not allowed to take the same responsibilities and who do not wish to take them. With such conditions, naturally the salaries in the central department will be larger and those in the reservoirs much smaller.

The men in the planning department's central office have the possibility of a greater influence on the company's earnings and good standing with the customers than do those of almost any other department. Production itself can be carefully worked out, jigs and fixtures can be made which enable a uniform product to be produced, and the inspection can be most careful, but the planning department can perform its duties effectively only as men for the position can be found who accept the spirit of the department's work and who have the ability to stand out against the temptation to make temporary friends with workmen, foremen, the sales department, or the superintendent. In order that the needs of the sales department may receive proper consideration in the shop, the planning depart-

ment should derive its authority from some one higher than the superintendent, possibly higher than the works manager, depending on the industry.

Scope of a Planning Department

In the beginning, the scope of the planning department is determined by the timidity of the management, offset by the confidence that it has in the individuals to whom it entrusts the planning. Changes from the old order of things inevitably mean friction. The friction may be all concealed; but, even if the

ROUTE SHEET

Part #611 Drawing #42 Order #1456

	Machine	Fixture	Remarks
Plane Bottom	36"X12ft.	None	6 at a time
Plane Across	36"X12ft	#24	6 at a time
Plane for Caps	36"X12ft.	None	6 at a time
Scrape Caps	Bench	None	
Drill Caps	24"D.	#25	
Drill End	24"D.	#26	
Bore	BM #3	#27	
Scrape Boxes	Bench	None	
Plane Vees	24"X6ft.	#12	1-Head & Tail together

FIG. 14

friction is only within the minds of people who are outwardly trying to make the change for the sake of pleasing the management, just so long as any one chafes under the new conditions there is not the efficiency that is desirable. Consequently, it is desirable that the rate at which a change to a new method of organization is made should not exceed the rate at which the men in the organization can make the change in their own minds. For this reason, it is not always that a full-fledged planning department is put in at once. It may be evolved from a series of reservoirs such as have just been discussed; or it may be

that a start is made at the opposite end of the line, in which case some one, possibly in the drafting room or engineering department, begins by making up routing sheets, such as are shown in Fig. 14, which become instruction sheets to the shop. When these are first presented, they may be put out as helps to the foreman; later they may be accompanied, in rush jobs, by red tags indicating the necessity for the work reaching certain stages by a certain date in order that delivery may be made when needed.

The shop routing sheets of the form shown in Fig. 14 cover the complete series of operations from the time the work is started into the shop, and the foremen are depended on to see that the work is handed from one to another. When there is friction or jealousy, individual orders may be issued to foremen to do a given operation on a piece or a lot of similar pieces. The forms then used are merely orders to a given department to do a given job, and to complete it at a given time, and to deliver it to another given foreman or to the inspection department or to whoever may be appropriate. While the plan is simple, it is an expense that cannot be lessened, because it requires clerical work by a mechanic, and that is always expensive; for there are so few mechanics that can do clerical work that it is usually necessary to make two jobs, a mechanic to decide how to route the work and a clerk to make the orders. Once this is done, however, it is only a matter of gradual and slow expansion to have a full-fledged planning department.

Functions of the Planning Department

The functions of a complete planning department cover the direction of all work in the shop, so far as it concerns methods of doing the work, routing it, and seeing that the methods and routing are followed. The planning department does not interfere with foremanship, in regard to the directions to the workman, but it does give definite directions to the foremen as to the machines to be used and the equipment to be provided for each job. The department usually has nothing to do with rate setting, nor does it usually exercise control over the erecting floor, except in such cases as erection or assembly is standardized and becomes a known or knowable quantity. Inspection usually goes along with planning, so that the department may catch errors of method as well as errors in operation.

As a usual thing, the work of the planning department begins with the material bought by the purchasing agent and ends at the erecting floor or at the final assembly; final assem-

bly is here mentioned, for many times a partial assembly of units is made and these are in turn assembled into the complete product. The endeavor of a planning department is always to have work planned ahead of the shop, so that there is at least one job ahead of every machine and every man, to see that the materials, tools, jigs, and fixtures, and every other thing necessary to efficient production are at the machine before the operator has completed his last job, and that the drawings and every instruction necessary are at his elbow long enough beforehand so that he can know definitely what is required of him.

Planning is primarily a function of superintendence, but since the planning department is in a position to speed up any one part of the work or to slow another down, it should, as already suggested in regard to reservoirs, be in close touch with the sales department, and be in a position to expedite work that requires it, and to see that red tags, signs of hurry, are not attached to things promiscuously without regard to the actual needs of the case relative to the rest of the jobs in the shop. The planning department should, therefore, be in a position to form a correct judgment as to the needs for hurry. Likewise it should have as long a look into the future as any one; therefore, the head of the planning department should be a man who is taken freely into the counsels of the management and who knows all their hopes and fears for the future condition of business, and he should reflect these things in the way he puts work into the shop. It is usually not a function of the planning department to say what product shall be made for stock as a whole, but the department is usually in a position to put into the shop enough of the parts that require long processes so that the firm will not be caught napping if orders begin to come in for quick delivery.

Routing of Work

The first step of the planning department, that of routing the work, may be very simple and perfunctory, as in the case of a corset shop where all of the product goes through the same operations and the variations are within those operations. The other extreme, perhaps, is in the machine-tool business where there may be two or three alternative routings, which may be used according to the exigencies of the case. The routing of the headstock of an engine lathe furnishes a good example. The following routings are used, and several more variations are possible:

1	2	3
Plane bottom (flat)	Plane bottom (flat)	Plane vees
Plane across	Mill for caps	Mill for caps
Plane for caps	Mill across	Drill for caps
Scrape in caps	Scrape in caps	Drill end and bore
Drill for caps	Drill all holes (jig)	Drill bottom
Drill bottom	Bore for boxes	Scrape in boxes
Drill end	Scrape in boxes	
Bore for boxes	Plane vees	
Scrape in boxes		
Plane vees		

Diagrams showing these routings appear in Fig. 15. Of these it is evident that No. 1 has the simplest appearance. This is the old way, still used in shops that have not the complete equipment which they would like. It does save transportation, but on the other hand the different operations require more skilled workmanship and give less certainty of interchangeability than either of the others. In No. 3 are included all the operations that need be performed, but all the drilling and boring is combined under one head and is done in one jig, but with interchangeable and quick-change drills and boring

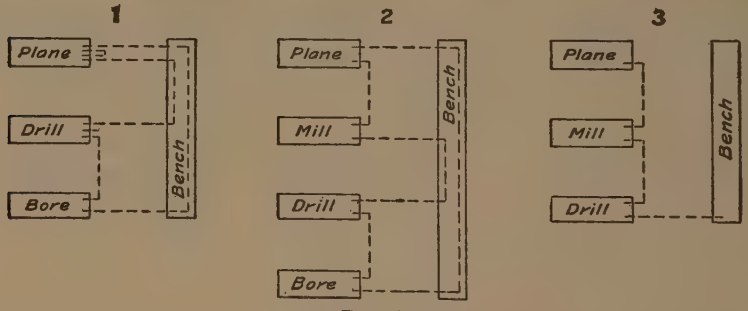

FIG. 15

bars. One transfer to the scraping bench is avoided by making the milling work so close that it is not necessary to scrape in the caps; this is entirely possible though not always attempted.

From this example, it is easy to see that routing work is not merely a question of using the most direct route geographically, but that it is always a compromise between the best methods of doing individual jobs and the best methods of attaining complete production. In such instances as have just been discussed, it is possible that it may be wise planning to change the routing of the work during its progress. For example, it may be that gang mills exist for milling the cap seats, but that they fit only one milling machine and that machine is tied up with a long and important job; then it may be much better to

revert to the planer with its skilled workman than to let the work lag while waiting for the milling machine to complete its long job.

As a usual thing, planning departments are expected to do the best that can be done with the equipment and tools that have been provided, but it is certainly part of their job to present new ideas to the management as to the best arrangement of machinery and the best machinery to have. They are in the very best of positions to have a comprehensive view of the whole matter, as they see the job as a whole, while an individual foreman sees only the flow of work through his own department and cannot be expected to give as much credit to the things which others say about the flow of work as he does to what he sees himself.

However, the planning department is also in a position to see the great cost of perpetual shifting of machines from one place to another, and is in a better position than any one else to realize the care which should be taken before being too much carried away with the craze for special machinery. Moreover, it should also be careful about the desire to cut down distance of travel between operations. Distance counts for little. It is the unloading or unfastening from one machine and the setting up and fastening on another machine that counts. A simple fixture on a planer or a milling machine so that castings can be made ready for machining in seconds instead of minutes will offset a great amount of distance travel. A sufficient supply of these fixtures or *cradles* so that they can accompany the castings from the planer to the drill will often make the drilling job so quick and simple that the castings might be carried a mile to another machine without costing as much as has been saved.

Routing Work to Specific Machines

So long as work is routed in a general way and the instructions come to the foreman to plane this place before that one is drilled, or the reverse, there is little friction with or among foremen, though even then one will occasionally be found who disregards instructions so long as he can keep the work in his own department. When it is decided to have the planning department route the work to specific machines or benches then there is a very considerable chance that friction will be created. This may be handled in one of two ways. The most common is by means of a definite written or oral order to the foreman. This stirs up all the antagonism at once and it all simmers down together, except in a few individuals who under this plan are demoted or dispensed with altogether. If the plan is strictly

adhered to, there is usually not much trouble; but if the superintendent has a few favorites among the foremen whom he "tips off" that they may take liberties with the planning-department routing, or if he tells the men to come to him with any complaints as to the routings which the planning department may make, then there is little chance of any but confusion and probably ultimate dissolution of the department.

The other plan is to place the whole problem before the foremen in a written communication and then to assemble them and ask them to criticise it, not from their own personal standpoint but from the standpoint of the good of the company as a whole. If the matter is put to them as a thing that is made necessary by the growth of the company and not because of any lack of ability on their own part, and if they are represented by one of their own number in the planning department, then there is a very good chance of success, because the men who do not fall in line will not have the support of the majority of the other foremen.

It is perfectly true in almost every case that the installation of a planning department is not a criticism of the foremen. It means that the problem has grown so large that the men whose noses are held to the grindstone by force of circumstances cannot expect to have a large, broad view of the problem as a whole. Moreover, it has been the experience of all time that the good of the whole demands some sacrifice of the best of each part. The details of a business must be subordinated to the best interests of the whole. When this is insisted on, however, as when a planning department begins to route work to individual machines, then there should be some way by which each foreman and, if possible, each workman should know what the interests of the company are and be in some way enthused with the spirit of the company and rewarded not only for personal efficiency but for cooperation and self-sacrifice. It should be fully recognized that it is a sacrifice for a foreman to allow others to come into his department and virtually "tell him how to run it," especially after the many years during which foremen have been building up reputations for themselves. However, if the management will show its appreciation for cooperation through the pay envelope, then cooperation becomes a thing to be given, and it is only the most stubborn foreman that will forego an increase in salary for the sake of maintaining his own way.

Visual Routing

It is easy to say that the planning department shall route work to machines, but routing is a very confusing job without some kind of mechanical assistance. The simplest possible plan is to have a large board with a peg for every machine and branch station to which the planning department may wish to route work. On the pegs can be hung tags giving the name or shop designation of the job to be done. Each tag stays on the peg until the job is reported complete. Consequently, there should always be at least two tags on every peg, one for the job being done and one for the next job to be done. Experience shows that some machines will have work assigned to them far ahead in point of time, and the pegs for other machines will be deep with tags for very short jobs. For example, the largest planer or lathe in the shop is usually in great demand and has to have its work planned far ahead in order that machines may have their largest part completed in time to begin assembly; but a key-seating machine may complete a dozen or more jobs in a single day.

In the case of the planer mentioned, the order in which the jobs are done is of considerable moment, but the jobs run long enough so that ample time is given for serious consideration of the time when other parts will be ready for assembly. The key seater on the other hand usually has a great many short jobs and only a few long ones. The order in which the work comes to it is therefore not nearly so important, except that care must be taken to make sure that a long job does not have to be broken up to do some very short one. This is easily managed with the tag system, for a man can run through all the tags that have accumulated ahead of the key seater and pick out any jobs that must be completed at an earlier date than the time consumed by the long job will allow, and get them out of the way before the long job is begun. The tag system is simple and easily started, and makes it possible at a glance to see that every machine is provided with work. It also enables a subordinate department of the planning organization to get the tools and material to the machines before the work then being done is completed, and thus saves time spent by workmen getting these things, which necessarily would mean lost time for the machine.

The tag system does not fill all the requirements, because it does not show how the different parts of a given machine or lot of machines are progressing. Theoretically, each part of the machine should start into the shop at just such a time that it

will be complete and ready for assembly at the same time that the principal member of the machine is ready to receive it. For example, in the manufacture of automobile engines, if it requires three times as long to machine the cylinder castings as it does the pistons, the pistons should not enter the shop until the cylinder castings are two-thirds done. Of course, it is not safe to plan in this way without any margin for errors and unforeseen delays, but within reasonable limits it is feasible. For the purpose of controlling this flow of parts, another board, called a control board, may be installed for each group of machines. This board would be arranged in some such way as is indicated in Fig. 16, in which horizontal lines represent parts of the machines being built, and vertical lines represent working days, dating *backwards* from the time when assembly should start.

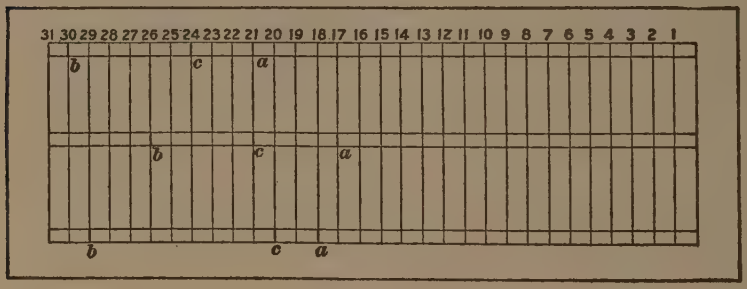

Fig. 16

On each horizontal line a starting point, or time, for work on that particular part is indicated by the letter *a*. This point is located a sufficient number of days before the time for assembly to allow ample time for completion of the part, with allowance for delays. Back of this point is another marked *b*, which indicates the time when steps must be taken to supply the material needed, and *c* indicates the time for securing the tools and fixtures necessary.

When the time indicated at *b* is reached, inquiry is made of the stores department to see that the material needed is in stock or that steps are taken to procure it through the purchasing deparment. Then, when the time *c* for getting out the tools is reached, they are requisitioned from the tool rooms and charged to the machine at which they are to be used. Then as the time *a* for starting the work is neared, the proper tags are made out and hung on the appropriate pegs on the routing board, which was previously described.

Of course there are many minor modifications of these plans. Some shops, for their control boards, use slanting shelves on which they place blocks bearing symbols of the parts, as shown in Fig. 17. Others use the shop orders themselves, instead of tags, on the routing board; but that is not good practice unless duplicates of the orders are made, as it is desirable for each tag or its equivalent to stay on the board until the job for which it calls is complete. The exact method to be followed is dependent on the product being made. A machine-tool shop might have

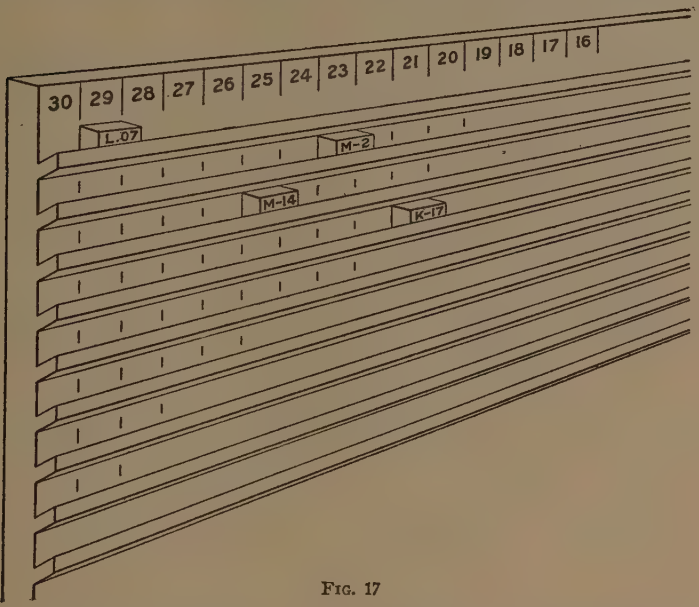

FIG. 17

forms very different from those required by a manufacturer of ladies' slippers; but neither can be worked out without a thorough acquaintance with the work being done. Every one should be on his guard against blind copying of methods or forms, because in the same general line of manufacture, even in the same identical line, there is a great chance for different methods to be successful. For example, suppose that the work is the manufacture of wringers. All wringers look very much alike to a man who has only noticed that they are a necessary part of his home laundry equipment, but the methods of manufacture may be entirely different in different shops and yet each shop may turn out a perfectly acceptable machine. The routing in one shop may necessarily be quite different from another, owing

to minor differences in design and to differences in equipment. The forms on which the different directions are given may need to be far different. For example, a small machine part requiring only a few minutes' total time for machining may have several operations performed that require a drawing on which are specified not only the dimensions of the piece, but the limits which within the dimensions shall be correct, the material of which the part is to be made, and specific instructions that operations shall be performed in a given order because of the necessity of making some of the later measurements from a base plane not ordinarily used. All these instructions from the engineering department must be followed even though the planning department feels that it could do the work more efficiently if allowed greater latitude.

Control of Tools and Fixtures

Under the old system, a set of tool-room checks was given to each employe, and these checks were exchanged by him for the tools for which he saw fit to ask. No limitations were made, and he went at his work as he saw fit, unless stopped by his foreman. Under the planning system, the individual workman should have very little reason for visiting the toolroom, but the tools and everything else needed should be brought to him at his place without any action on his part. It is true that there are many places where each man is still allowed to pick out the tools he wishes, but the number is growing less all the time. If the planning department knows enough to plan the work, it should certainly know what tools should be required. To the extent of honoring requests for tools at the proper time, the tool rooms should cooperate with the planning department. In fact, since almost all their dealings are with the planning department it is natural to count the tool rooms almost as a part of that department. However, the planning department has enough to do without adding to it the actual design of small tools and fixtures, which is strictly a mechanical matter, after it is once decided to supply them. So it is desirable to place all designing, whether of the product or the tools and apparatus for making it, in the hands of the engineering department, which presumably is in a position to do that best. However, it is necessary to check a true designer, as otherwise he will bankrupt any firm with his new ideas which he wants to see expressed in expensive metal before they are digested and before the public has been educated to want them.

The planning department, then, should function as the

ordering agent of the company, so far as tool rooms and stores of materials are concerned. It should, therefore, be assured that its orders will be honored promptly so that there will be no danger of loss of production from failures to supply tools and materials as ordered.

Very few superintendents realize how much is lost through lack of prompt supply of tools and material. They do not realize, or they forget, how skilful men become at "stalling" on the job. No workman cares to call down disapprobation by appearing to be loafing, even though it may not be his fault. Therefore, as he sees the end of one job coming and the next job not in sight, he slows down, spends more time fiddling over his tools, finds a place where the machine needs readjustment, and otherwise busies himself doing nothing that advances production. This is occurring in the shop every time there is a delay of materials, every time that a man has to wait for another man to get through with a machine or a tool.

The planning department, therefore, should be in a position to demand, and get, an adequate supply of small tools and fixtures so that the most efficient production is reached consistent with the size of lots that can be put through.

Size of Lots

Manufacture ranges from entirely continuous manufacture, in which a continuous flow of material is always passing through each operation, to the manufacture of specialties, where a single machine may be under construction with no prospects that another will ever be made. Between these two extremes there is a great range of choice in regard to the size of lots put through the shop. The size of these lots is influenced by the knowledge that the sales department has of the market, the condition of the company's treasury, the state of the money market and the company's credit, and the nature of the shop's equipment. The planning department is the department which must carry the brunt of the load whenever it is decided to increase the size of the lots carried through. It knows, first of all, whether the equipment will stand the increase, whether each lot will take twice as long to go through the shop if the size of the lot is doubled or whether the setting-up time is so great in proportion to the time that is spent on the operations that the handling in larger lots will actually speed up production by the year even though it slows down the delivery of each lot.

Effect of a Planning Department on Foremen

Under the plan proposed by Taylor, foremen in the old sense were to be replaced by men each of whom exercised certain functions in which he was an expert. These men were as follows: A teacher of quality of work, really an inspector on the job; a teacher of methods, motions, and procedure; a man to see that the most efficient speed was maintained; a repair boss who took over the workman's machine for the time being for any necessary repairs, whether to the machine itself or its driving mechanism; a time clerk, who exercised full authority over the workman so far as his relations to the pay roll and the reporting of work accomplished were concerned; the routing boss, whose business was to see that the work came to the workman in its proper order: and on top of all these was a disciplinarian.

While all this looks at first sight like flying in the face of Providence, and calls forth quotations about serving one master, the fact is that each of these functions is so fully defined in shops which Taylor reorganized that each man knows well to what foreman he is responsible for certain things, and each foreman, knowing so well his own limits, is not tempted to go over into another man's field. However, not many shops have taken over the Taylor system unmodified.

The function of such systems which has made the greatest impression is that which the planning department offers, and even that function is very often used without any difference in the foremanship, except that the foreman finds that his choice of jobs for given machines and men is overruled. Theoretically this is right, but practically there is found to be a great difference in the ability of men who are of necessity entrusted with similar machines. If there is but one big lathe, then all the work over a given size must go to it, no matter what the method of routing is, but if there are a hundred 18-inch lathes, then there must be a hundred different qualities of men handling them. The man at the planning board cannot visualize these men and their qualities, and yet that is just what the foreman has to deal with. He may find that one man is really very good at thread cutting, but makes a fizzle of every face-plate job that is given him; and yet the planning department may very likely send a job of face-plate work to that very lathe, and the foreman has to spend a great amount of his own time getting the job done. However, a little tact on the part of the foreman will give the planning department this information and secure its

cooperation, which may consist of some private mark on the planning board which signifies that all face-plate work should be kept away from that particular machine. It is only good cooperation for the foreman to let the planning department know these peculiarities of his men and equally good cooperation for the planning department to heed the advice.

The Services of Foremen in Planning

Of course, every shop is likely to have foremen who know so much more about how the work should be done and how it should be routed through the shop, that they try to find flaws in everything that the department does. Naturally, they can find flaws, because it is so much easier to tear down than to build up. But if the shop is to be run for its best profit, the organization must be cooperative. Men who do not and will not cooperate, in spirit as well as in material things, simply have to make way sooner or later for those who will. However, it should be borne in mind that a foreman who makes a constructive suggestion is entitled to be heard, and to know just what the objection is to adopting it, if there is any. If he is not told then, he is likely to think that there may have been an ulterior motive. Once he begins to be suspicious, there is no knowing just what he may do, for suspicion breeds suspicion; therefore, as a part of his education, the firm will find it advantageous to tell him just what the reason is. Not many foremen realize that the firm has any limitations in the expenditure of money, and not many realize the sales problem nor the dangers of overproduction, and unless these various sides of the question are explained to them they will judge the firm from their somewhat narrow viewpoint.

Foremen like to have a large amount of work from which to select the jobs for each man to do when the one he is on is completed. Such a condition is desirable from the standpoint of suiting the ability of each workman, which is something that is quite likely to be inefficiently done with a planning department; for there is seldom a great gain without some small loss. The gain in available room in the shop due to the smaller amount of work in process, and the gain in capital account from having less material in all stages of manufacture all over the shop, is enough to compensate greatly for this one possible loss. Many a firm has been driven into a receivership by the stock in process, which if turned into cash would have saved them. The only way to avoid having so much in the shop is not to start the material moving until the shop is in a position to use it.

This does not of course apply to manufactures in which the material is required to season, as in the furniture business, but it applies even there so far as the room in the shop itself is concerned. Foremen, therefore, should be made to see the advantage to the shop as a whole which comes from having only live work going through and from the keeping of all the stationary material in store rooms if it is necessary to have it at all.

The Planning Department at the Erecting Floor

It is plainly the job of the planning department to see that all the parts and tools necessary for assembly of the finished product arrive at the erecting floor when they are needed. The question arises, should the department attempt to plan the erection? This depends on the product and on whether the product is assembled piecemeal or all at once. If the product is a machine tool, like a lathe or a planer, the assembly is around a main casting, or bed, of the machine and all the parts are fastened to or fitted to it directly or indirectly. In most cases, the final assembly consists in attaching units that consist of other parts already assembled elsewhere. In cases of this kind there is no doubt that the planning department should direct the time of assembly of the units which go to make up the completed whole, so that they will arrive at the final assembly at the proper time.

In other cases the assembly floor is too small for random erection work and the time of assembly may be fairly definite and regular. This applies to work that is manufacturing, in distinction from merely building a machine. An engine-building shop may make a series of small standard, stock engines, which are assembled in certain established ways and for which the assembly time is fairly constant because the parts are made with fixed tolerances. At the same time, they may build some large engines, that are made singly and the erection of which is not a known quantity and which it would appear to be foolish to ask the planning department to supervise, because it can only guess at the obstacles that will be encountered. There probably are instances in which the original drawings have been so well and carefully worked out that the machine goes through without alteration and all the clearances are found to be ample; but that is the exception that proves the rule. Generally, every new design is found to have some things that have been overlooked and some things that have to be changed, and that cannot be predicted by the builder. In such cases the planning department cannot fairly be asked to assume responsibility for the

progress of the machine, but it can be held responsible for the arrival at the erecting floor of parts which should fit into their proper places if the design is right.

In some cases, there are parts that cannot be completed until assembly has been begun. For example, there are certain bearings on many machines that have to be correctly alined, and the alinement cannot be made with certainty except on the machine, the parts being afterwards removed to make the fitting permanent. Such work is hardly ever within the work of the planning department, because it is an uncertain matter which is necessary to the perfection of the machine and which must be done well no matter how long it may take. It is, however, often possible to assign certain machine tools to the use of the erectors only, even though these machines may stand idle for a time, as the advantage of keeping the work of erection going continuously is of great importance.

MANAGEMENT

Rate Setting

There are three customary ways by which shop rates are set: First, by allowing the work to go on in the usual way, noting the time required, and then setting piece rates or standard times a definite and arbitrary percentage less than the customary rate or time; second, by tentatively setting piece rates by a method which it is not intended to follow, finding out how rapidly the work can be done that way, and then establishing a new way of doing it as a result of the experience, and setting a new piece rate for the new way. The third method is to make up the rate by experiment and analysis of other jobs and then to set a scientifically accurate rate based on what can be done with the facilities offered. The first is the usual method, the second is ethically unsound, the third is apparently expensive but the cheapest and only sensible method in the long run.

The first method, the stop-watch method, is the one that has brought scientific management into disfavor in many quarters, enough so that many people judge scientific management by the stop watch rather than on its merits. Workmen almost automatically slow down as soon as they catch the click of the watch. It seems hardly fair to ask a workman to be a party to the reduction of piece-work rates unless as he may bid them down in competition with others.

Moreover, public opinion is very much against treating labor as a commodity. There appears to be the same objec-

tion to ruinous competitive bidding for jobs that there is to ruinous competition among manufacturers for business. That is, the manufacturer who objects to price-cutting methods by the salesmen of his competitors should not be a party to rate cutting among his employes even though they may want the work badly enough to do it. Rate setting, therefore, should be done with due regard to the minimum wage, which is usually understood to be sufficient to provide a living according to American standards. Setting such a standard wage is, however, sure to work many hardships during times of business depression; for, if enforced, it compels manufacturers to lay off entirely, many of their employes to whom half a loaf is better than no bread. The truly fair way to meet an inevitable slacking off of business is to give the men who need the work enough to do so they need not go too deeply into their savings, even though for the time it may give each family so little that they cannot maintain that comfort to which every one feels that he is entitled. Any minimum-wage law should, therefore, be so administered that in times of depression the work available may be distributed according to need, rather than according to efficiency. The manufacturer owes this much to the community that gives him the opportunity to exist.

Rates for Women and Children

The primary reason for employing women and children is their willingness to work for less than men will. In times of great need they may be brought into the shops because there are not men enough available to do the work required. In any event, they act to lower the scale of wages in all activities; because, even though they do not compete for the more laborious kinds of work, they relieve men who can compete for it.

Employers find that women do not by any means turn out equal work under the same conditions as men. Women are considerably more inclined to be absent. In many cases the percentage of absence is from 50 to 100 per cent. higher than with the men. They also require better working conditions. This last is, however, something that an employer ought to hesitate about saying, as women do not require any better working conditions than men ought to require. Safety devices, for example, have to be somewhat more carefully installed for women than for men, but largely because the public is more affected by injuries to women than by the same injuries to men.

Toilet facilities, lockers, and the general cleanliness of the shop all are things that demand more attention as soon as

women appear on the pay roll; and yet they all are things that the shop might well improve for the men, unless they are already good enough for women.

The real test, however, is earning power under a straight piece-work system. A case has been known where a girl took up a piece-work job which had netted men around $16 per week and made over $60 on her second week in the shop. This was a case where she earned her pay, and under the conditions it was given to her. The men who had worked on the job previously were well laughed at by their comrades for their failure to make good on the job, yet it never appeared but that they had worked well and faithfully. Usually, however, it develops that women, using the same facilities, do not earn as much week in and week out as the men do; they require more porterage, and they do not so readily make the necessary repairs and adjustments to the machines which they operate. If such is found to be the case, rates for them should be set according to what they do accomplish, with due regard for the fact that if they accomplish less than normal the overhead charges go up on account of their presence in the shop. They use just as much space for their work as men do, and usually as much power and quite as much light, and all these charges enter into the overhead charges which have really to be paid out of their gross earnings.

The same drawbacks that apply to the employment of women apply also to the employment of children, whether female or male. In the case of children, also, there is another kind of public sentiment and an increasing tendency of law makers to provide that children shall attend continuation schools, during working hours. The loss to the employer on account of the time taken up by these schools is more than the loss of the wages paid, because the time lost by the children increases the ratio of overhead charges to their wages. The gain from this schooling from the employer's standpoint is practically nothing for the time being, for most of the children look on the continuation work as a half holiday. Then, the schooling that they get seldom has any immediate application to the work they are required to do or which they may be promoted to do. If it did, it might become more interesting and they might the sooner be ready for promotion.

Practical Rate Setting

Rates set from the practical experience of the person who sets them are by all odds the most satisfactory of all. Next

to these are the rates that are arrived at by proper reasoning and are deduced from experience. The first mentioned can be arrived at by making what amount to laboratory tests, trying different ways of doing a given job and then providing the shop with the tools and fixtures and adequate instruction so that the work can be done exactly as was found best in the laboratory. The man who makes the tests should not be a man who expects to earn his wages doing the work that he is trying out. He should be a mechanic who is selected for his ability as a workman and also for his tendency to work things out, in other words, his ability as a student, not of books, but of mechanical things.

A laboratory of this kind is simply a room into which the machine on which rates are to be set is sent, set up, and run on the product which is to be rated. The machine should be in a room by itself for the sake of secrecy, and so that the general run of men in the shop will not know how many failures there have been. The air of mystery that comes from having a separate room is also valuable, as it makes it possible to secure cooperation through fear that the workman will not be able to do as much work with the new method as is required of him. Of course, with very large machines this is not possible; but what few experiments are performed on such large and expensive machinery have to be done in the light of similar experiments on smaller scale, so they become mainly confirmative rather than original. These experiments are both for motion study and for method of procedure. For purposes of motion study, the motion-picture camera is of great help, even in cases where the movements made are slow enough so that it would seem a simple matter merely to watch them closely. In cases of rapidly moving machinery, nothing except instantaneous photographs of one kind or another really shows what is going on. The motion-picture films when run very slowly through the projecting machine show all the awkwardness of the operator magnified many times, and at the same time they show the action of cutting tools on the work, and even the operation of a grinding wheel is made much more clear.

Experimentation should, however, always be carried on one step at a time. Any attempt to change more than one thing at a time between experiments results in confusion and doubt as to which change made the improvement or which decreased the efficiency with which the job was done. For example, in testing out a lathe job, the speed of rotation of the work should not be changed at the same time that the feed is changed, as no definite knowledge is then gained as to what it is best to

change next. The work should, however, be done by a man sufficiently skilled so that he can reproduce the work commonly done in the shop, as to methods, and who is amenable to instructions to change first one thing and then another and allow the observer to note the gain or loss on each. However, it is not usually best to carry the changes in any one element of the work to a conclusion before trying changes in another element. For example, in a lathe job, it is not best to go to the extreme possible speed of rotation of the work before trying a change in the feed. It is, of course, possible that there may be two points of equal and best efficiency, as the same work may be stiff enough so that a heavy feed and slow speed may produce the same effect as a light feed and rapid cut.

Synethetic Rate Setting

Theoretically it should be possible to do away with experiment altogether and make all rates over the drawing board. That is, it should be possible to compute all the consumption of time in advance of the construction of even one machine. For example, it may be that a shaft is stiff enough so that any cut that the lathe will carry is permissible. In that case the rate of feed is determined by the kind of cutting tool used, and it may be safely assumed, if the shaft is of moderately low-carbon steel, that a cutting speed of 70 feet per minute is most likely to be efficient. Then it may be assumed that the coarsest feed which the lathe affords is possible, and the coarest feed may be ten cuts to the inch. From that and the known diameter and length to be turned, it is easy to figure the actual cutting time. To this must be added the time spent in preparing the work, getting it into and out of the lathe, time spent in grinding and adjusting the cutting tool, and in making the necessary measurements. In the case of a shaft of, say 5 inches in diameter, and 3 or 4 feet long, not requiring steady rests, this calculation method is entirely possible and, of course, very much cheaper than the experimental method.

However, a great deal of work, even in machine-shop practice, is not sufficiently rigid in itself to enable the fastest speed of the machine or the quickest feed to be used. A shaft may be so long and slender that the greatest care is needed, even in roughing it out, to enable it to be made true enough so that it will grind down to a true cylinder. Possibly experiment will show that it can be ground from the rough to advantage without sending it to a lathe at all. This might be deduced by a man of long experience; that is, a man who had performed many

experiments, even though he might not have recorded their results except in his mind. Other work is usually done on a mandrel, and the fear of its slipping has formerly made machinists very careful as to the size of chip they have taken. If it is still to be done in this way, it is likely that a man familiar with that work can tell how large a chip the workman will dare to take; but without experimenting he cannot tell, nor could the workman, how large a chip might be taken. On the other hand, if the piece is held in a chuck for the rough turning, the speed can be very definitely determined by computation, as can also the depth of cut and the feed. Since modern tendencies are all toward doing work by this latter method and obviating the necessity of slowing down production on account of the frailty of the work itself, there are more and more parts that can be rated without much experiment. This makes it possible merely to try one or two experiments on each piece of work to confirm the estimates made synthetically.

Waste of Time in Placing Work in Machines

As soon as figures are available for the time actually spent in doing useful work, the apparent inefficiency of almost all shop work is brought to notice. In any ordinary machine shop the machinery runs, actually cutting metal, for an average of about half the time. During the rest of the time, the interest and depreciation go on; nothing stops except the consumption of power, and even that is so largely consumed in driving shafting and countershafts and in the idle load on motors, that the saving is very little. Anything done to minimize the time spent in getting a machine ready for a job, or a job ready for a machine, effects a double saving; first, in the actual time consumed, and second, in the saving of overhead charges in proportion to the work actually turned out. For this reason, when piece rates are to be set, every effort should be made to make, beforehand, whatever changes in design and tool equipment are necessary to avoid loss due to the parts, as designed, not having sufficient strength to stand machining in the most effective manner. The automobile industry has probably carried the designing of parts for economy in making to greater lengths than any other line of manufacture. There, in the best factories, very little work is done on a mandrel, save the last truing up of the parts, but everywhere it is made possible either to use rapid feeds and speeds or broad-faced forming tools at slow speeds. Moreover, much work formerly turned in a lathe and merely trued in a grinding machine is now ground from the rough and fin-

ished in the same machine, and that, too, in some cases, with grinding wheels shaped to the outline desired and brought up to the work exactly as is a forming tool.

There is also a great waste of time due to lack of enough straps and blocking to set up a job on a planer or a milling machine in a proper manner. These machines are very expensive, consume a great deal of power, and occupy much valuable space. Moreover, the work which they do is apt to be on large and expensive parts of the product, which tie up considerable capital if held long in process. Often, however, such machines stand idle while the operator is hunting all over the shop for enough straps to fasten the work securely in place. Inasmuch as all the accessories that can be used on such a machine do not cost over ten per cent. of its total cost, it seems like saving at the spigot and losing at the bung hole to let such waste continue.

Everything that has been said regarding machine-shop practice applies in some degree to all other manufacture, although it does not seem possible that the waste is so great, especially in the highly specialized industries like shoes, textiles, and wood working. In all of these, the setting of piece rates, or what is the equivalent in case of premium plans, etc., the base rates, needs careful study. In shoe and textile work, however, there is a very uniform practice, partly the result of union organization, and partly the result of inertia, so that there is not so much opportunity for investigation and study. Wood working is nearly as badly off as machine work, for lack of definite knowledge of the rate at which work can be done and handled. It is a revelation to a man accustomed to the leisurely ways of pattern shops and cabinetmaking establishments, to go into an up-country bobbin shop, or where pails or any other of the standard wooden products are made. It is natural to find that industries in which there are a limited number of definite operations are much better understood and more standardized than is machine work, which has an almost infinite number of combinations of operations that must be worked out for each part. In a shoe shop the number of operations is variously given from fifty to one hundred, according to the method of manufacture and the number of operations that are combined with others, but these operations are well established for each shop and not nearly so subject to improvement as in less standardized industries. Rate setting in a shoe shop is thus a much less complicated matter than in a machine shop. The same thing applies in textiles, envelopes, and all paper-using trades like publishing, book binding, etc.; for in all these trades, with the exception of a few machines,

there need be almost no loss of time between jobs, and the machinery can be in operation nearly all the time except while it is out of repair.

Changes of Rates

The best method of rate setting is of course the one that secures a fair rate with the least expenditure; and yet this expenditure is really a capital charge and should therefore not be treated in a niggardly way. The benefit to be derived from established piece rates that do not have to be changed after they are set, except by addition or subtraction of uniform percentages as prices go up or down, is a great help to the morale of any shop. It takes years of experience, however, to convince a shop full of men that piece rates will not be changed if they do their best to accomplish all that they can under them. Once their confidence is gained, however, there is a wonderful advantage.

However, there is an inflexibility about a shop operating on a piece-work basis, for it is not easy for the firm to cut down the price of its product to meet the market. The only legitimate way to cut piece rates is to take a given percentage from every operation. This corresponds to a definite percentage cut in day rates and is just as hard to do. Then, with piece rates there is always suspicion and objection whenever an improved machine for a given purpose is brought into the shop, while such action hardly produces any effect in a shop working on a day basis. There is always the fear that the new machine will be made the basis for a cut in rates which will be more than the reduction produced by the machine itself. All these contingencies operate to make men do somewhat less than they might day by day, so as to have a reserve for emergencies like a cut in rates, covered up under some subterfuge.

Many times it happens that a firm is formed to manufacture something that is then fashionable. After a time the fashion dies out and the only market left is the legitimate one composed of people who have a real need for the article. In such cases, the price is almost certain to drop, and the shops that survive find it necessary to scale down wages in order to keep running at all. In such a case, it seems to be as well to prepare to let all the old hands go and hire new ones at the new rates. There is not much morale among a group of men who feel that they have been cheated out of the right to a good living, and yet, no matter how small the wage offered, there are always men who are ready to come in and try to do the work for a time at least. These new men may be floaters, but there will inevi-

tably be some among them who have become tired of floating and who will like to stay in that particular shop if the non-financial rewards are sufficient.

Sliding Scales

There appear to be some very definite advantages in a sliding scale of wage rates based on the market value of the materials or of the product of the company, but with provision for an advancement instead of a cut if the workman succeeds in making a very good record. The actual setting of such rates is, however, a very delicate job, and it is an equally delicate task to put them in effect on the downward swing, which is inevitable whenever business is poor. In fact, the most difficult task of the rate setter is to find a way in which contraction in rates can be carried out without violence, at least of thought, when it is found essential.

There seems to be no chance that the time will ever come when violent fluctuations of business will not be prevalent, and so long as fluctuations persist, employers will have to be in a position to make wages fluctuate according to the cost of living and the market for the products of their shops. The upward movement is easily taken care of so soon as there is the money in the treasury to take care of it. The downward movement, while it is equally simple on paper, is not readily accomplished without a nearly complete change of help. Part of the difficulty with the downward change is due to lack of a complete understanding of the economic factors which enter into manufacturing, and part of it is the natural feeling that any one who takes away from another money that he expected to have is as reprehensible as the man who takes it out of another's pocket without the formality of establishing a right to it. For this reason, a form of payment that makes it apparent to all employes that a part of what each receives is temporary and due to abnormal conditions is a great help when reduction becomes necessary. The following explanation shows the reasoning upon which such a plan is based.

If, when the cost of living goes up 50 per cent., for example, the day rates, piece rates, and premiums are all increased by 50 per cent. and the whole amount is paid in a single pay envelope, the workman comes to think of it as an increase in wages, just as he would if the amount were a reward of merit. When prices go down, he does not see that his merit has decreased and he resents having a cut equal in amount to the former increase. Then, too, there are always a few employers who seek to take

advantage of men's credulity and drop wages 10 per cent. which they had formerly raised 10 per cent. Only a few workmen really see that the difference is against them.

If, however, these increases, instead of being made a part of the weekly pay, are made entirely separate as a bonus, this whole trouble is obviated. The workman continues to look at his regular weekly pay envelope as his wages and at the bonus envelope as a bit of good luck to compensate for the way his grocer and landlord have raised their charges to him. This method is exactly as applicable to piece rates as it is to day wages, except that under day wages a man may naturally expect an increase in pay from time to time as a result of his increased ability, which should show in his regular pay envelope rather than in the bonus envelope. Under piece rates these increases in pay to individuals are automatic; for, as he increases in skill and familiarity with the work, he is able to do more work and accordingly gets more pay, on top of which is added his bonus for increased cost of living.

Handling Individual Complaints About Rates

No matter how well piece rates or base rates are set, there will be inequalities and inaccuracies. These, together with many that are entirely imaginary, will have to be considered as they are brought up by the workmen who feel that they are not able to earn the wages that they should. In some shops where these inequalities are well known and the management is reluctant to make changes, it is customary to give the poorly paid jobs to new comers as long as they will stand it. This method in itself almost assures that a sufficient number will leave in disgust to require the hiring of enough new comers to take care of the underpaid work. It is, however, a very expensive way of handling the matter; for it adds greatly to the number of men who should be classed as learners, and they are always expensive, and especially so if the investment in their training is thrown away by letting them leave before they have accomplished sufficient production to make an adequate return. It seems certain that every complaint in regard to rates should be thoroughly investigated and a demonstration made of the correctness of the rate. No one should be allowed to go away without having seen the work done rapidly enough so that a usual wage can be earned. For that reason the department that sets rates should comprise on its staff enough thoroughly skilled workmen so that there will be no fear on their part that workmen can "show them up."

INSPECTION

Kinds of Inspection

There are two kinds of inspection; that for size, which may be as accurate as circumstances may require; the other, for appearance, which depends on personal judgment only. Most inspection in connection with manufactured products is for size. In the manufacture of furniture, pianos, and artistic goods of all kinds, the standard of quality is, however, very largely personal, but immensely vital. For example, certain few lithographers have reputations which enable them to secure prices for their work which must be greatly envied by their competitors. This reputation is established on the appearance of their product, and is usually found to emanate from some one man who knows what he wants and who simply insists on getting it. In fact, all kinds of inspection are finally reduced to a persistent and never-ending refusal to take anything except the quality of product established by the management.

Systems of Measurements

Inspection by measurement presupposes an accurate system of measurement, such that articles may be duplicated accurately, not only day by day, but after the lapse of many years. Two systems of measurement are in vogue, the English and the metric. Many attempts have been made over a long period of time to secure the universal adoption of the metric system as the only system in this country. The most comprehensive answer to this demand probably lies in the fact that the system has been permissive in this country during all that time, and that if it were better for our use it would long ago have displaced the English system.

That the metric system has many advantages is apparent. It may be compared to the monetary system of this country. We would assuredly find it difficult to change from dollars and cents, with its ease of decimal computation, to the pounds, shillings, and pence of England; and yet, so strongly are we inclined to divide our units into other than tenths that we find many articles for sale at 12½ cents each, or cloth at 37½ cents a yard, these prices being reminiscent of the old-time York shilling, which was an eighth of a dollar. We, however, overcome all objections to this system by thinking and acting in terms of dollars and cents, and we no longer concern ourselves with the mysteries of the shilling. In much the same way we overcome the complexities of changing from miles to feet and inches, by

simply sticking to a single unit in the larger part of our work. We measure boilers in inches of diameter no matter how many feet the dimensions may prove to be. We measure buildings in feet and inches regardless of the number of yards, and we measure carpets in yards and fractions without regard to feet and inches. In weights we for the most part cling to the pound alone. To be sure, coal dealers mystify us by the use of the long and short ton, but the hundredweight has gone almost completely out of existence. Almost the only place in the shop where any complexity arises in regard to measurements is in those few instances where feet and inches are used, and even there many advantages are found in the division of the foot into twelfths rather than tenths. A foot 10 inches long would divide without fractions into only tenths, fifths, and halves; but the 12-inch foot divides evenly into twelfths, sixths, quarters, thirds, and halves, which is quite an advantage.

The metric system is used by optical instrument makers, and to some extent by manufacturers of small tools and machines for export to countries in which the metric system is used. Lathe manufacturers, for example, have to furnish their machines with metric lead screws for export to France, but in general do not have to make the measurements of the parts of the machine conform to metric standards.

Tolerances and Limits

The inspection department is principally concerned about the amount of variation that may be allowed from the standard called for. In the building of ordinary machinery, for example, where no attempt at interchangeability is made, it is customary if a piece is made too short to try to find some way to use it on the next lot by altering some dimension of another part. Such practice is, however, confined to things which are not strictly manufactured, but which partake more of the nature of custom-made goods. The moment manufacture begins to be on a large scale, it is necessary that there shall be such uniformity that the assembly room need not be a complete machine shop. In order to obtain such uniformity, it is necessary that the inspection department set, or have set for it, the limits above and below size which it may allow. Since it is most natural and easiest to make holes first and fit shafts and studs into them, the hole is first made of standard size or a limited amount under size, and then the shafts are made enough smaller to allow for a running fit, if that is what is required. An interchangeable drive fit depends on the elasticity of the metal of the two parts

and on whether the hub of the part into which the shaft is driven is small enough to allow of stretching. As little as a tenth of a thousandth of an inch may be allowed for variation in small holes, but it is very expensive to set the limit so low that the holes will have to be reamed by hand. Reaming by hand almost always results in holes that are somewhat bell-mouthed; to secure the extreme accuracy referred to, the reamer must be started with its axis truly coincident with the hole which is already there. Machines are not made or kept in sufficiently good alinement so that it is possible to machine-ream to such small limits, so the only thing that can be done is to use a series of reamers with projecting guides which fit well into the holes as drilled. By grinding, holes may be produced of the degree of accuracy mentioned and without extraordinary expense, if the part in which they occur is readily held in the grinding machine. Large holes like the bore of an automobile engine can be ground on machines that are adaptable to other work that must be held in a fixture. These machines rotate the grinding wheel on its own shaft, whose center is the axis of the cylinder to be ground.

Once it is decided how much variation may be allowed in the size of the holes, it is next necessary to determine the allowance in size for lubrication. This requires a certain looseness of fit and permits of a considerable amount of variation in size of parts, as oil will take up the slack even though there is quite a large fraction of a thousandth of an inch difference in size.

Place of Inspection

Once the limits of allowable variation are established, it is necessary to determine at what stage of the work to make the inspection. Shall it be on each piece after all the operations on it have been completed? That is the cheapest way so far as cost of inspection alone is concerned. Or shall it be at the machine after each operation is completed, and deal with the parts at once before other parts are spoiled through poor or faulty adjustment of tools, wear of parts, etc.? This last plan is expensive, because it is often almost as much of a job to find whether a piece is right as it is to make it. In a room full of automatic screw machines it may easily take more inspectors than workmen to keep the product up to a close standard and not spoil work as it goes through. In such a case, the inspectors become to all intents and purposes workmen to whom the machine adjusters are assistants.

Modern management, as it has grown out of scientific man-

agement, is more and more coming to make inspection in the shop and on the job a part of its organization. The inspector who has everything brought to him in a distant room is more impersonal to be sure, but this does not seem to be a case where impersonality is necessary. The whole efficiency of a shop and its morale are improved, especially on anything but day work, by making the inspection an intimate matter, following so closely on the work that there is no danger that time will be lost and work spoiled by letting men go ahead in wrong ways or letting poorly adjusted or alined machinery spoil the work.

The inspector, however, should be a part of a different organization from the workmen whose product he inspects. This makes it easier for the inspector to do his work fearlessly and carefully. If a workman and the inspector work under the same foreman, there is always pressure to let something pass that is not quite up to the mark, but which is "practically just as good." It is just such exceptions that throw interchangeability out of the shop. Wherever there is a superintendent who occupies what is virtually the place of works manager, the inspection department is usually made responsible to him, and is included with the engineering department, the planning department, and so on, while the leading foremen and subforemen have direct charge of the carrying out of the orders of the superintendent. In theory, the planning, the engineering and the inspection departments are advisory to the works manager, but practically they give their instructions directly to the parties affected, unless in case of disagreement; in which case the charted course is pursued. Work thrown out by the inspection department should be accompanied by a tag showing cause of rejection, which should come to the foreman of the department in which the rejection takes place, so that he can determine whether or not the piece can be more cheaply saved than replaced. He should also have the chance to defend the workmanship if he disagrees with the inspection department. In some places there is a committee on rejections, which determines what is to be done with the rejected parts; but more often the decision is left entirely with the foreman. The difference in practice seems to depend on whether or not the nature of the business is such that the rejected part may be usable as material for a small part, as, for example, in the manufacture of grinding wheels, one that is spoiled for a 12-inch wheel may be turned down for a 10-inch, and so on.

Inspection and Test of Finished Product

The final inspection of the finished product is done on the assembly floor in the case of large heavy machinery, and in a room by itself when there is an opportunity to do so. Certain alinements should, however, be looked over by the inspection department when the adjustments are made, subject to being looked over again after the machine is pronounced complete by the production department, for fear that adjustments may have been jarred or pushed out of place. The final inspection of a machine should be under running conditions. An automobile should not be turned over to a customer until it is known that it will run, and that the adjustments are such that it will run well and that it should give satisfaction. A milling machine is not ready for delivery until it is certain that it will perform all of its functions without jar, vibration, or chatter marks. The simplest machine, even if it is only a nut cracker, should have enough of a test to be certain that it will function as intended. It is not necessary in order to test out a power punch or shear that it be made to cut or punch up to its full capacity. The strength to do its work was given it in the design with an abundant factor of safety. If the machine will run at the standard rate and cut off a small bar, there is no need of supplying it with the power necessary to cut the larger bar. The same thing applies to all machinery, because the factor of safety in its design is, or at least should be, enough to make sure that if the experimental machine will do the required work, each succeeding machine will, if its mechanism is like the first.

Speed of Work

Textile work depends for its output on the speed of the looms and other machinery, a wire-nail machine is belted to run at a given rate which the operator cannot change, a metal planer has but one cutting speed; but the weaver can keep his machines going a larger or a smaller percentage of the time according to his ability or disposition, the man who handles wire-nail machines can do the same, and the man operating a planer has the whole range of feeds from which to choose the most efficient.

Variation in Speed

A lathe or grinding-machine operator has a multitude of combinations of speeds and feeds available. His value depends on the proper choice. The foreman's chief function formerly was that of a selector of proper combinations in such cases;

today if scientific management is carried to its conclusion the same thing is done by a *speed boss,* whose function is to specialize in speeds and feeds. It is his duty to see that machines are actually running up to speed; that is, to see that belts do not slip or that motors are running at proper speed, and that the machine itself is able to deliver the requisite power at the point where it is used. The need of care in regard to the latter point is apparent in almost any shop; for it will often be noted that machines are not heavily enough belted or the motors are not powerful enough, to enable the machine to do the work of which it is capable.

There is no loss quite so unjustifiable as that due to a large, strong, well-designed machine staggering along and half running with belts tightened up to the last degree and yet not delivering the power which could be used to advantage. An example of such a condition was furnished by a 36-inch lathe designed and furnished for belt drive capable of delivering about 7 horsepower; but the machine did not work up to its real efficiency until geared to a 50-horsepower motor, when it began to do really effective work. Its production up to that time had been less than half what it should have been. The interest and depreciation on the machine, the rent of space it occupied, and the man's wages and share of overhead charges were about $20 per day, so that the loss at the very least was $10 per day, and the saving of this paid for the motor and the extra power used many times over in the first year after the change. It is true that designers of machine tools are paying much more attention than formerly to the power of their machines, but even yet most of them are designed by rule of thumb and entirely from past experience, and not from a scientific point of view.

Other machines, such as printing machinery, looms, and paper machines, appear to have been much further evolved in the direction of sufficient power, doubtless due to the fact that the purchasers and users of these machines are not mechanics and they feel no compunction about speeding them up faster and faster and then strengthening parts as they give way, until the maximum production possible with the material on which they operate is reached. A mechanic always feels reluctant to speed up a machine tool. He is accustomed to a certain rather leisurely pace, which he considers inseparable from exactness of workmanship, and to go beyond that to him means injury to the machine. The employer whose only concern is production takes all that into account, he realizes that rapid wearing out of the machine is inevitable, but he likewise hopes

that some one will invent a better one before the present machine wears out. He is concerned with immediate production, rather than with the preservation of machinery.

Work of the Speed Boss

For the determining of questions regarding speed and power, specialists who are mechanical men, but not too mechanical, are desirable. They must have little mercy on the machinery that they are speeding up, but they must have the proper conception of the human element, because their work goes hand in hand with that of the rate setters. If a machine is speeded up and more production is obtained, then the man who operates the machine should be paid in proportion to the work which he has to do. If doing this addition work has brought increased activity, or if it has brought increased responsibility, both should be taken into account. It sometimes happens that a man who is all right when working at one speed will go to pieces and suffer a nervous breakdown if confronted with the necessity of handling twice as much work, no matter how much the pay may be. The mere fact of the increased speed of the machine may make another man so confused that he cannot stay on the job, no matter what the financial inducement. For this reason it is necessary that the human side of these matters be given careful consideration. Many men appear to be slow, and to need "jacking up." For such men it is often the very worst thing that could be done. They are simply so constituted mentally that they have their pace and they cannot exceed it.

Laziness is not so common as is generally supposed. Many men who appear lazy have not the full mental equipment of the average man, and cannot, and should not be expected to, do all that may be put before them. Such men, however, are better off where the requirements are not great; their places are rather those of watchmen than of active participants in production. They may handle material for automatic machines and report breakdowns, or they may work in many places where faithfulness is of more importance than initiative. It is in regard to such men as these that the speed boss must exercise care. If the employment department is sending him the wrong kind of men, he should see to it that the right specifications are given to that department, but in general he should not be troubled by precedent when he is looking into possible increase in production.

On more purely manual work, as, for example, the making of scraped fits on machine slides, the boss can only see that

work is not accepted for scraping which can be brought nearer to true by further planing or milling. He can see that the men who are employed are physically fit for continued exertion, and then he should endeavor to have them paid in such a way that they will put forth their best efforts. As a general thing, no other part of the work of assembly can be going on during scraping; therefore, all the time that can be taken out of that is so much gained on delivery of the finished machine and so much less time that the erecting floor is tied up with the machine. It is, however, necessary that scraping be well done, as otherwise it had best be left undone. It is necessary, then, that not merely physically strong men be employed, but also men of sufficient intellect so that they can reason, from the markings that the parts they are scraping make on each other, where the least scraping will produce the most effect.

Similar ability is necessary for all kinds of hand work, such as lapping bearings, laying out holes to be drilled, and so on. The intermediate work, that of machine operators, can be done by men of no very great intellect, and in some cases of no very great physical strength, if they are amenable to training and are sufficiently careful so that they can make adjustments on their own machines.

WAGE METHODS

Day-Rate Method

There are many plants in which it is impractical to install any method of paying wages other than the day rate. This method applies in very few cases to the plan as a whole, but more specifically to certain kinds of labor. Usually, it embraces the highest type of labor, and in many cases the labor that does not result directly in the production of any article.

The day-rate plan pays each workman a certain wage for a certain number of hours' work, the amount depending mostly on the skill called for, partly on the locality in which the plant is placed, and partly on labor conditions. The severest criticism that can possibly be made against this plan is that it removes the incentive for a workman to do his best. Under this plan, defective work usually is not penalized except through dismissal when it becomes too common to be tolerated.

An argument stated in favor of the day or hour rate is that it insures a constant labor cost, and one that is easy to apply. This argument, however, overlooks entirely the fact that uniform labor cost is not uniform cost per article.

Piece Work

The best known and most abused method of getting production by means of financial rewards is the piece-rate plan, in which a price is set for doing each operation or group of operations. The principal disadvantage of the piece-rate system is the danger of setting rates without positive knowledge of just what the workman can earn if he will. A common cause of error is the attempting to set a rate on a new job from observation of the time required to do the work with insufficient or makeshift equipment; but there are still more cases where the man who sets the rate simply does not know how to do the job himself, nor how fast it can be done without undue weariness. Theoretically, piece work is the best system to use, for the earnings are easily figured, as they are in direct proportion to the number of parts done. It is easily understood; but its weak point is in the necessity for having the rates set by experience, and prorated scientifically for different sizes and variations, and it has only been recently that men who could combine experience and science were available.

Premium System

Under the premium system, the hourly rate is guaranteed to each workman so long as he is retained on the job. A standard day's work is set. If he exceeds that amount, he receives from a quarter to a half of the saving. For example, suppose that his hourly rate is 50 cents and that he is supposed to do a given job in 8 hours. If he does this work in 6 hours and the premium is one-half the hourly rate, 50 cents additional will be allowed him for the 2 hours which he has saved. If he goes on and completes the 8-hour day at the same rate, his total earnings for the day will be $4.67, or an increase of one-sixth in his pay for accomplishing $5.33 worth of work. The purpose of the premium system is to do away with some of the apparent loss due to the rate fixer's lack of knowledge of workmen's capacity for production.

Under the piece-rate system a man who is skilful and slightly avaricious may make large wages for a short period of time. While he is earning this high rate, there is a great tendency on the part of managers and superintendents to cut him down, either directly, or by rearranging the work and establishing new piece rates, which is not much better than a subterfuge. Under the premium system, this increase in productivity is not rewarded in proportion to the amount produced, but excess pro-

duction only brings from a quarter to a half of the extra pay that would be earned under a straight piece-work rate based on the same conditions under which the basic or normal production is figured for the premium rate.

The advantages of the system are that the men know that they will continue to get their hourly rate plus whatever their premium may be.

Differential Piece-Rate System

The expression, *differential piece-rate,* does not convey exactly the idea that it should, but the name is in use. The system consists of setting two piece rates, one for slow workers and one for rapid men. The piece rate for high production is the higher rate of the two, which is the direct opposite to the premium plan. That is, the man who achieves the rapid production rate finds his efforts very liberally rewarded suddenly. If he drops back below the limit, he finds that he has lost just as suddenly. This system can be installed safely only where the work is sufficiently repetitive so that plenty of time and effort can be put into finding what a man can be expected to accomplish. Under this plan the good workers are so liberally rewarded, so long as they keep up production, that there is not much danger of their being attracted by other shops operating on other plans of payment. On the other hand, the penalty for not keeping up to the standard rate is so prompt and acute that workmen are in no danger of becoming puffed up. The plan ultimately eliminates most of the slow workers with the exception of those few who have become reconciled to small wages and to whom surety of employment is of more consequence than large pay. That is, those who have lost hope or who have a sufficient income from other sources so that all they require is a place to spend some of their time and nothing to worry about.

The differential piece rate recognizes that increased production reduces the overhead charge per unit of work, and shares that reduction to some extent with the workman. The principal objection to its use is the considerable addition to the overhead, occasioned by the expensive study of the methods of production before it is put in effect. It will not do to base the two piece rates on past experience with either day rates or straight piece work. It should be based on experiment and analysis of the job into its elements, almost into the motions to be made in performing operations. For example, the scraping of a lathe carriage onto its bed may easily take 10 hours for a medium size and length of lathe. If, however, the planer hands who

plane both parts have had a little experience at scraping, it is possible to get the planing so well done that the required time for exactly as good a job is only 2 hours. The excess time for planing is not more than a few minutes per piece. If this work is put on piece rates or on differential piece rate, then the scraper hand who finds that he can earn so much more if the planing is well done may very likely offer a substantial bonus of his own to the planer hand; because, the expenditure of a few minutes' extra time may make this rapid scraping possible. In such a case, the rates for both planing and scraping should have been so set as to make it profitable for both men to do their best work, first by giving the planer hand a liberal enough rate so that he will not leave his work rough and distorted in order to make the higher piece rate, and second, by making the rate for the scraper hand such that he will, by diligence and the application of brain power, complete the work within the time allotted.

Task and Bonus Plan

One of the troubles with the differential piece-rate system is the difficulty of getting men to make the necessary effort to reach the higher piece rate. To overcome this trouble, Mr. H. L. Gantt used a plan which gives each man a guaranteed rate for the time spent; but if the man reaches or exceeds a predetermined production, called a *task*, he receives a bonus in the form of additional time allowed. This bonus may be as much as a quarter or a half of the time taken to complete the task. The task is usually high and the bonus is high to make it worth working for.

This system has the advantage of a sudden jump in pay earned if the task for the day is accomplished. In other words, it has the psychological effect of giving or withholding a substantial reward according as a certain limit of production is reached or not. The workman knows that he will have to pay close attention to his work to make this reward; therefore, he is not likely to develop egotistical tendencies. Another advantage is that each man knows that he will make his day rate, and that whatever he gets above that is his incentive for the extra work. Therefore, his profits, as distinguished from his guaranteed day's pay, are plainly apparent.

The Bigelow Bonus Plan

Under the Bigelow bonus plan, a piece rate is set which grows larger as production increases. The low, or initial, rate is set for a production that all can attain easily. That is, if a

man can at the very outside produce 100 pieces per day, it is assumed that any man may reach 60 pieces, for example, and a piece rate is set that will allow a living wage to be made at that rate of production. Whenever the man pushes up his production above the 60 pieces, his piece rate is *increased* so that if he should reach the ideal, or 100-per-cent. production, he would receive a 40-per-cent. increase over his piece rate. This gives a larger inducement for production than any of the other systems, and is directly contrary to the old piece rate with its constant cuts whenever a man succeeded in finding a way to make a large income. It frankly says that large production effects such decrease in overhead expenses that the management can better afford to give the money to the workers than to people who merely add to the overhead charges, important though they may be. One objection to this system is the temptation which it puts on an employer to reduce rates, as in the old piece-work plan, when business is very bad and the only way to get it appears to be to cut prices, which is a temporary expedient only. Another objection is the danger that men who are overambitious may injure themselves by overwork. The method should not be applied to purely manual work without a stopping place; because, even though some men might be well able to do a great amount of work without injury, there will inevitably be many who must be hired in order to get all the work done, who would be badly injured if they did all the work that a large, strong, and capable man can do.

Motion Study

Motion study implies that after a study has been made and the motions that appear to be the most direct and efficient have been discovered, the men in the shop will be taught to use those motions in doing their daily work. The last part of this process is where the difficulty comes. It is not easy to teach people to make motions in a certain way. Motion pictures taken of people working or playing show some surprising things. For example, runners, who make every effort to win races and to establish records, have never standardized their gaits. Nearly all run with some awkwardness. Sometimes the winning runner has a beautifully smooth action, but he is likely at any time to be beaten by some runner whose awkward stride makes one feel certain that he is running largly on his nervous energy. Whether the awkward runner uses up his nerve supply more quickly than the other, it is hard to tell, for the champion is allowed so little time for recuperation and rest that he is almost

certain to have to give way to another soon unless he is able to resist the social strain.

Application of Motion Studies

In this same way it is often found that the man who is producing the most work, day in and day out, is using motions that none of the other workmen would think of, so that he is not the example to put before the others. The whole matter is so puzzling that no definite solution seems to be possible. A great deal of good work has been done, not so much by trying to teach men new motions, as by providing apparatus such that the work will be less tiresome. For example, if a man has his work brought to him on a truck of about the same height as his bench, so that all he has to do is to slide or roll the material off, and if when his work is finished he can pile it directly on another truck instead of first putting it on his bench and then from there loading it onto the truck, he has made the first step toward easy motion. If, however, the man is left-handed there is very little use of trying to teach him to be right-handed. If that was to have been done, it should have been done when he was a very small child, and the result even then would not have been at all certain. To try to get a grown man to change his natural way of doing things is almost as hopeless, but changes in machines by which all the handles ordinarily used will be conveniently located, and the provision of handling devices to make the manual labor as little as possible, are legitimate and profitable.

In the vocational schools or in any training for the manual trades, motion study or the teaching of efficient motions to a class of beginners is likely to prove valuable. Psychologists say that it is very important that in the learning process no backward steps be taken, that a person who has begun to learn to do a thing in a certain way finds it much more difficult to learn a new way than if he had no training at it at all. For the purpose of study, the motions of a person who does the work well and with the least waste of motion should be taken as standard, rather than the motions of the person who makes the highest record. Gilbreth has used photographs of men taken against a screen marked in squares, so that the relative, and to some degree the positive, extent of motion may be ascertained. There are two things to be attained by motion study, one the elimination of unnecessary motion, the other the elimination of sudden stops and starts; in other words, the elimination of jerky motions. For example, a man swinging a sledge in a blacksmith shop or quarry will tire less in proportion

to the work done, if he swings his sledge in great circles and does not follow the blow down hard on the anvil or drill, than will the man who makes his blows by raising and dropping his hammer in the same arc of a circle, and putting his weight behind each blow. While this is an extreme case, the same reasoning and experience applies to almost all work done in shops. It is especially noticeable that where the work is tiring the production falls off and accidents increase as the day goes on.

Method of Making Motion Studies

The machinery of motion study is simple but expensive. It consists of a moving picture camera, a time clock with a large face, usually without any hour hand, but having a second hand making the full circle of the face, and the necessary ruled screens as backgrounds to show the motion made. Many motions would be better shown if two cameras and two screens were used, so that motions in three dimensions would be shown. Such equipment is not likely often to be provided, however, on account of the expense. Some good work has been done with an ordinary camera with a slow plate or else a poor light, but with the prominent and essential points of the operative, as, for example, his hands, chalked, or carrying a little electric light. For such work, the shutter and diaphragm should be set so that the total time of one complete motion will just give a complete exposure for the whole scene, then the lighted point will describe a curved line on the plate or film and thus show the motion of that particular point. These photographs are very interesting and instructive, even to the men who pose for the pictures, as they find that they have made involuntary motions of which they have not been aware.

REPAIRS AND UPKEEP

Who Shall Make Repairs

As soon as a shop outgrows its first environment, the question of who shall make repairs begins to make itself prominent. When the factory has reached the continuous-production size, there is only one answer, that is, to have a repair department and let no one else make any repairs. Between the two stages, there is a great deal of room for argument, and the decision in each particular case is not to be found by the use of a slide rule or rule of thumb.

Shops that employ highly skilled men for practically all of their productive work cannot refuse such men the privilege of

making their own repairs and adjustments. It is cheaper to have them make them than to have the repair gang, because the repair gang could not do the work so well nor so quickly. However, as soon as operatives who are not skilled mechanics begin to come into the shop, so must the repair gang. Now the company is making the most money when the repair men have no work and the least when they are working the hardest. Yet the repair men know that it is only human nature for them to be dropped from the pay roll unless there is work enough to keep them busy. For this reason, it is wise to have a combination of repair gang and "flying squadron" of all-around workmen who can step into any department at a moment's notice to take the place of men who are out temporarily. In that way, the men who are called on for repair work are stable members of the organization.

Some shops go so far as to deny all their production men the privilege of making any repairs or adjustments on their machines, and prefer to have a man stand entirely idle, or if some one else is absent, to take another machine for the time while the repair gang is working on his. This is carried so far as to put all belts under the care of a belt expert; and, while it is not often that the elaborate care is given them that was proposed by Taylor, there is a great deal more systematic care of belts, if they are all taken up and laced, or otherwise joined, by one set of men who go into all departments of the shop for that purpose. In any shop where belt repairing is haphazard, there is every variation, from belts slipping so that the workman can hardly take a cut light enough to keep the machine going, to those where the belt is so tight that it is pulling its fastenings out and being ruined.

The Repair Gang

The one thing that is most used as an argument against a repair gang that takes over all repairs, is the fact that it so many times results in having the machine operator standing by entirely idle. The loss due to his idleness is visible, and his wage rate is usually pretty well known to the management, while the loss due to the lack of the use of the machine is not so well known. Since the overhead charges in almost every shop exceed the wages paid for direct labor, it really is more expensive for the machine to stand idle than for the man. If the repair gang can get the machine back into commission and running at full rate in half the time that the man could, it surely pays to have the gang do it and let the operator stand idle. The

question is thus purely a mathematical one, if the relative abilities of the average operator and the repair gang are known. Too often, however, the repair gang does not exert itself to complete the repairs as quickly as possible and with regard to keeping production as continuous as possible.

The great difficulty is that there is no basis of comparison for most repair jobs. Occasionally there is a standardized repair job that can be put on a piece rate. Such a case is usually merely the replacement of a part that normally wears out regularly. Any other job, no matter how well estimated, is almost certain to develop unexpected complications, some of which may be imaginary and might not complicate the work if the repair gang were provided for and knew that their jobs were safe even if the repairs became small in amount. Something is needed that will compare with the Chinese method of paying a doctor a fee for the time his patients are well and penalizing him for the time they are sick. The only solution that has so far been found dependable is to employ only men of high grade, pay them well, and give them constant and intelligent supervision. Some men are adapted by nature for emergency work and are not happy unless they have it. The more urgent the need for their work, the happier they are. Such men are, however, restive under a time clock. They want to work hard, wear themselves all out, and then have a chance to recuperate. The shop that can build up a gang of that kind of men, and is wise enough not to hold them to exact hours, and that rewards rush work by relief from restraint, is fortunate.

Wholesale and Retail Manufacture

Certain products are made by continuous methods of manufacture and require for distribution only that they be divided into certain quantities and shipped. To this class belong textiles, shoes, wire, bar steel, and similar goods. But even these goods have, for certain purposes, their special variations, for which a larger price is willingly paid and from which a profit may be derived. A textile mill may have its looms working steadily on a certain fabric; but if the need arises for another pattern, even though it is only for a few yards, there is almost always a price at which it will be profitable to stop a loom, make the required goods, and start it up again. Or a mill may get a reputation for doing these odds and ends and keep a few looms running on short jobs so that it can readily take more.

There are many concerns that take the position that they are wholesale manufacturers only and that they will not take

odd jobs, no matter how closely these may be related to their regular line. Nevertheless, many others find it imperative that they complete a customer's order so far as it relates to their manufactures, instead of trying to have him split it between themselves and a competitor.

There are two ways of meeting this emergency, one by having two shops, one a jobbing shop, the other a wholesale shop. The other method is to handle the two in parallel, letting the same organization do both, and filling the short jobs in between the long ones. The separate jobbing shop is used by some of the large wire manufacturers, who, in some parts of the country, devote entire plants, employing many thousands of men, to the filling of small orders for specialties. These plants are located where the most highly skilled men are to be obtained, men who ask and get the top wages. Their other plants, the wholesale shops, are at a distance, their employment departments hire a lower grade of men for all but the leading places, and they turn out the work rapidly and as well as the market demands; but the best work is in the jobbing shop.

The method by which wholesale and retail work is carried on in the same shop seems to be better adapted to the machine-tool business, or to the manufacture of things like grinding wheels, where a customer is amply justified in saying that his work is "different" and requesting special wheels. If a customer orders thousands of wheels of a standard size and specification, it is impossible to refuse him a single wheel to meet some special need, and of which he may use the one for a year or more before it is worn out. A manufacturer of lathes also has the problem of being able at the shortest possible notice to turn out, not only lathes of a given swing and ordinary length of bed, but he must be able to deliver longer and shorter lathes with the minimum delay. In these two cases, the only logical method is to handle the wholesale and the retail business in the same shop, and in parallel.

The planning methods and cost keeping for the separate jobbing shop are obviously to be arranged for such a shop, and need only a careful study of the work, and adaptation to its special needs. Where, however, the work is carried along in parallel, an especially keen and active planning department is required. In fact, without a planning department such a shop is totally lost, unless it has one of those superhuman superintendents that can keep a thousand and one things clear in his mind at once. The planning department needs to be thoroughly in touch with the sales department when this retail business is

to be handled, for it must get the spirit of the sales department, else it cannot see the inevitable loss which these little orders cause without wincing, and being constantly tempted to sidetrack little orders for big ones.

Special Orders

It is reasonable to assume that any shop in which the orders average as much as a thousand dollars each is likely to lose money on a five-dollar order that has to be made up and shipped separately. In fact, if the cost of the planning department is charged directly to the jobs on which work is done, which it should not be, then it is doubtful if a five-dollar order can be followed through the shop for as little as that amount, and thus the entire shop cost is left as a loss.

Of course there are salesmen who will encourage a customer to order a single article and experiment with it, when they might secure an order of reasonable size for something that they know to be adaptable to the customer's work. However, the sales department should be the judge of the advisability of accepting the small orders. They may have especially good reasons. The order may be experimental and be almost sure to fail. If the latter, it may be that there is no other way to convince the customer that he is wrong except to let him try it himself. It may be that the customer is a little shop which cannot afford to buy more than a single thing, where its competitors have been buying in carload lots. There has been a great deal of money lost trying to make big customers out of little ones, but most of it has been lost by inducing them to overbuy rather than by selling them their necessities at a little loss and helping them to build up their own line.

Once the retail order is in the shop and marked *Rush*, as most of them are, it should have as much of the right of way as is possible with due regard to the company's obligations to larger consumers. It is seldom necessary to stop a running job and put in the short job. In a printing establishment running on large orders of calendars for New Year's, for example, it should not be necessary to shut down a press, start it up for a short job, and then start it up again for the running job. The work going through the shop should be so timed that there will be a press completing a job as nearly every day as possible. Then a short job can be sandwiched in between two large jobs without any greater expense than comes from doing small orders in any case; and it is to be expected that the sales department has attended to that, either by making the price such as to make a

profit, or else by charging up the extra cost to advertising or to investment in the future profits to be made from the small customer.

This process of putting a special order through the shop together with large orders is very like a small boy wriggling his way through a crowd. He does not know which way he will turn until he comes to the chance to duck under one man's arm, to go to the left of another man, and to the right of the next. In the same way, it seems impossible for the planning department to lay out these little jobs in any very scientific way until the job reaches the department in which work is to be done. In a measure, this does not seem to be following out the scientific basis on which work is normally routed by the planning department. However, the practice may be justified, since the profits of the company come directly from the large stock orders, and these small orders are likely to be productive of stock orders in the future.

Another phase of the retail manufacture is encountered when it is desired to take a portion of a lot that is coming through in regular order and push it through for early completion. If the planning department has arranged to have everything for the whole lot come to the assembly floor at the time it is wanted, or with only enough leeway to insure that accidents will not delay final completion, then pushing a part of a lot ahead means a doubling of routings, which is difficult and usually results in the rush work taking about the time that was planned for the whole job, and the rest of the order being much delayed. If, however, it is expected from past experience that it may be necessary to split orders for the sake of filling emergency demands, then it is wise to carry in stock, or at least to provide in advance of the larger and more expensive parts of the machines, those parts on which the labor expense is large in proportion to cost of material or storage space. If this is done, so that many small parts can be taken from stock in advance of the expected date of completion of the whole lot, then the rushing of one part of an order ahead of the rest becomes a matter of a new routing for only the larger parts, which require relatively less labor than the small parts that have already been put in stock.

The cost of manufacture of these smaller parts has probably yielded to the efforts of the efficiency department, and the labor cost is probably much decreased by making them in large lots. Many of the smaller parts may be screw-machine products or they are made in jigs and fixtures on milling machines and drills,

without the need of fitting each to its place. As a result, the cost of carrying these small parts in stock is not large. In fact, since only large shops can afford to have enough machines to carry on the manufacture of all kinds of parts at once, it will be necessary in any case, for the sake of economy, to make the small parts in lots that are multiples of those in each manufacturing lot, and to maintain an adequate supply in stock at all times. For example, suppose that automobiles are being built on a rather large scale. It may be that a lot of 100 is the normal unit into which each shop order is cut. It might then be wise to make many small parts in lots of 500, 1,000, and in the case of screw-machine products possibly many more, if the labor is a large part of the total cost when they are made in small quantities. It should be noted, however, that there comes a time when the apparent advantages of production in large quantities is only imaginary. When tools require resetting, and the machine readjusting, and when the interest and storage charges on the product become a considerable factor, it is best to consider whether these expenses may not altogether outweigh the advantages gained by producing in large lots.

Continuous Production

In continuous production, a machine is assigned a certain job and kept on it indefinitely. When there are repairs to be made, the machine is shut down, and production of the article made by that particular machine stops unless a battery of similar machines is working.

Continuous production can be arranged and set going very much as we build a clock, wind it up, and set it going, with the exception that there is the human element to deal with. The human element shows itself in the high turnover of labor, the unrest which comes with monontonous work, and the tendency of the people in the higher offices of the company to invent new things and to broaden out into them. Very few single-purpose products have stayed such for many years at a time. The dollar watch and the Ford car are two notable examples of long life with a single purpose. Both, however, show signs of breaking out into general manufacture; the dollar watch now sells at from $2 to $6 according to the style and finish, and the Ford car has gone over into tractors. We are an inventive and many-sided people and we cannot long restrain ourselves from showing it.

Successful continuous production has been found to depend on the ability of the management to reduce the work to opera-

tions that can be performed by people who are neither inventive nor many-sided. The work has to be done by emigrants from those European countries where the people have been subject so long that they do not expect anything different. Otherwise the workers will shortly tire of the monotony of the job, and will find other places to work. This cause does not, however, show on the analyses of labor turnover by the employment department. It is very seldom that men say that they are leaving a job because it is too monotonous. Sometimes they will say that the work gets on their nerves, but more often they stick to the work until they get a job which they think they will like better, and then say that they have found a better job; from which the employment department infers that they mean that they are to get more money.

For these reasons, it is virtually impossible to fill a continuous-production shop with the class of employes that can get the most out of the equipment. Therefore, manufacturers have given up trying to get a high quality of men for such work, and have set a low wage rate for the kind of help that will stay an appreciable length of time.

These men are necessarily of low mental age and are correspondingly slow mentally. They learn to do their own particular job very well, however, and with what passes for celerity compared with the awkward way a green or inexperienced man would do it.

It is no more than to be expected that they will see only the side of things that is brought to their attention. For this reason, production in mass should not be undertaken without some definite attempt to rotate men from one job to another at intervals.

The Planning Department

The planning department of a single-purpose factory should be kept, if anything, slightly undermanned, as otherwise it will have time to invent new routings and better ones, while the greatest profit from such work lies usually in a policy closely adhered to, even though it may not be the best. So it is usually wise to give the routing of work a thorough study once for all, try out the routing planned and make whatever changes a short experience indicates, and then settle down to that as a routine, resisting any thoughts which may occur in regard to changes even though they may seem to show the possibility of a considerable profit.

Costs in such a factory need hardly be followed with the persistence necessary in shops making a variety of goods. If the

product is turned out within the standard time set by the planning department, the cost is pretty well known from past experience by taking into account any changes in the wage rates or cost of material which may have taken place. The moment any part of the work slows down, the fact is very noticeable and does not need the services of a cost department to point it out. Occasionally, however, the actual cost in each department should be taken for a time and studied and compared with previous costs.

Graphic Production Control

In connection with the work of the planning department, and as a means of visualizing the progress of work, a number of plans have been used to make the progress of work evident to the eye. In principle, these are all alike; but many minor variations have been made or proposed and undoubtedly many more will be.

Principles and Methods

The underlying principle is that of representing by a line of suitable length the time which it is expected it will take to complete each unit of the work, and then, day by day, if possible, showing on each such line what proportion of the work has been done. This plan requires a board or chart on which there is a line for every operation on every piece, and this line is blacked over, or colored, or covered with a colored ribbon as fast as the work is done. If only a single operation is to be done on each piece the lines may be parallel and of the same length. In that case, if each lot comprises 100 pieces, then the number of pieces completed is the percentage completed. For any other number than 100, the percentage completed would be computed, which may be done on the slide rule or by means of a chart showing percentage by proportion.

The method just described is simple, effective, and useful, for it shows any foreman and any workman whether he is keeping up to schedule or not. It is human nature for every man to work better if he has something to aim at, a definite something he can try to do. This is true whether the mark is the bull's-eye of a target, a school record for a mile run, a shop record, or the number of bricks that can be laid in an hour.

Men may not be willing to start in a race until the prize for which they compete is set up and acceptable to them, but once started there is no holding them back.

No one wants to run a team race unless he is convinced that the team has a chance of winning and that the other men

will do their best and not leave it all to him. The use of a graphic production record sets up a race from the very start, even if the chart is on exhibition only to the foremen. If the record is shown to the workmen and understood by them, it brings the race nearer to them and saves in the supervision required. If this method of exhibiting progress is accompanied by a method of payment that increases the reward in proportion to the exertion put forth, and if at the same time there are ample non-financial rewards, there remains only the one fear, which is that some men may overexert themselves. There is, however, a possibility that, if every one began using all these methods, the profits would be so large and the output so great that some would begin to feel the need of cutting prices of product and in turn cutting prices of labor. This in itself would be fatal to the success of the plan, for the very essence of success with piece work or any of the premium and bonus systems is that rates shall not be cut, least of all on account of successful performance. It is likely that in the use of these plans there lies something which will make the organization of labor merely social and which will render it harmless and unnecessary.

Value of Graphic Records

When a man is breaking a record, or coming close to it, he deserves the best that the company can offer in the way of making his work easy, and not only does he deserve it but it is a very good investment for the company to give it to him. If, then, piece rates are set scientifically, as has previously been suggested, if a suitable allowance of time is made by the planning department so that the workman has that length of time on which the piece rate was based to do the work in, and if he has his tools, drawings, gauges, and everything that he needs to do with brought to him, together with the proper and necessary stock, if he is taught the best way of going at the job and his work is promptly inspected so that he cannot go wrong for more than a few minutes, and if on top of all this he is paid extra money for production in excess of the normal amount set by the planning department, then he will not require any welfare plans to induce him to produce the most that is in him; he will only want a fair field and no favor, with working conditions such as his superintendent would want if the two changed places. Given all these things, and unions can have little influence counter to the shop. And the shop will not have much to criticize in its men. It will attract men who can do the work so as to make a large profit. However, the way to show the workmen

how they are getting along is through their eyesight. In that respect they are very much like the president of the company. In fact there are very few men who will not spend a great deal more time studying a chart, drawn in plain terms, than they will in perusing columns of figures, and they will get much more from the chart.

Graphic Control of Varied Operations

In many cases, a number of operations are required to complete a part; and if even one of these operations is neglected, the parts are useless to the assemblers, their work will stand still, and the delivery of the finished machine or product will be delayed. To insure that no operations shall be overlooked and

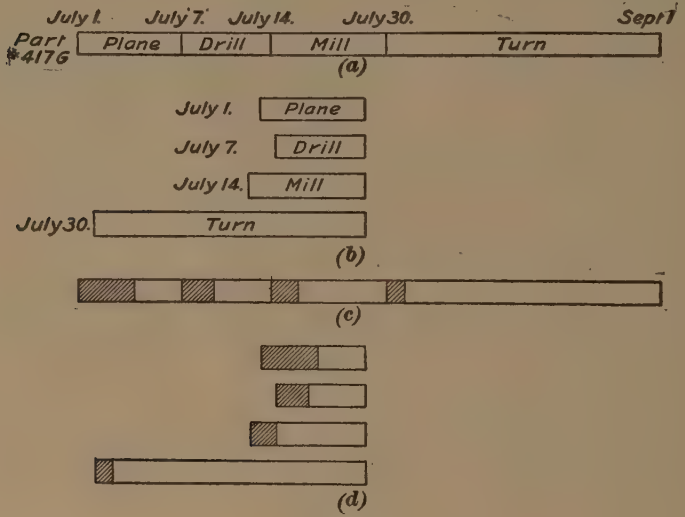

FIG. 18

that the various operations shall be completed at the proper time, a chart similar in form to those shown in Fig. 18 (*a*) or (*b*) would be used. These charts represent two methods of charting the work to be done on Part 417G, and show when each operation is to be completed.

Either form shown may be drawn to a large scale and posted where all interested can see it. The form shown in (*a*) takes up less room on the chart, but the form in (*b*) might be more easily understood by many persons. If all the parts are put through one operation before any are sent to the next, the form shown in (*a*) is very good, because a ribbon wound on a

spring reel, like a tape measure, can be set up at the end of each line and pulled out to correspond to the progress of the parts. The same thing can of course be done when the form shown in (*b*) is used, but a spring tape would be required at each line. The same result is obtained by using colored crayons with which to block out the lines to represent the progress made. This use of crayons is especially convenient for indicating the proportion of each of the various operations that is completed when work is being rushed through. For example, as soon as some of the parts 417G begin to come from the planers, they may be rushed to the drills without waiting for the whole lot to be planed; so also on the next step some of the parts may be started on the milling machine before all the parts have been drilled. If work is rushed in this way, a chart originally laid out as shown in (*a*) may, on July 6, have been marked so that it will appear as shown in (*c*). This chart might not be readily understood by all workmen. If, however, a chart like that shown in (*b*) were used, and marked to represent the same progress as that shown in (*c*), its appearance would be like that shown in (*d*) and might be more easily understood.

Of course, if the charts are for the use of the planning department only, there is no need of anything but the single line as in (*a*), for each part, and the chart may be very small so that it can be kept on a moderate-size drawing board; but if the psychological effect on the workmen is desired, it will have to be large enough and so located that it may be seen by any one that has the curiosity to look. It may seem that some men spend a great deal of time looking at it, but once they get its full significance there is bound to be a great inspiration to accomplish things, if the other conditions mentioned are favorable. Of course, there will be those that see in any plan of this kind only some sort of a scheme that the management is trying to put over to the detriment of its employes. Some may jeer but stay to fall in line or they may in a few instances fall out altogether; the others may simply fall in line and be surprised at the amount in their pay envelopes or they may sink out of sight and gradually disappear. It is certain that this plan of organization gives every one an opportunity to make money for himself and does not offer the company any opportunity for exploitation that is not offered by any other system. Moreover, it puts a premium on fair play by the employer, which none of the other methods of management does, in that it assures the company of the opportunity for a substantial decrease in overhead charges as compared with the direct pay-roll system.

Workmen who are busy on account of their own interests require less supervision, and when they turn out the added work that they can, due to the fact that they have the materials, etc., at hand instead of having to hunt for them, the overhead becomes a smaller percentage of the larger output.

EMPLOYMENT PROBLEMS

Production by Overtime

The charge per productive hour of labor is much less if the hours are many than if they are few. That is, there are so many charges that go on even when the shop is shut down, and so many others that do not increase in direct proportion to the hours worked, that there is always the inducement to consider the use of overtime or the employment of two or even three shifts of workmen. Nearly every one that tries night work, and especially a night shift, is desirous of dropping it after a rather short time, but usually because of personal choice rather than because of a question of economics.

Workmen do not like night work except for the money that it brings them in excess of that which they might otherwise earn. If two gangs are employed, and one gang is kept continually on night work and the other on day work no power can prevent the best men gradually filtering into the day gang. The night gang is blamed for everything that goes wrong, it is least supervised, and has the greatest opportunity to spoil work without being caught. Moreover, no one really expects much of the night gang. If the matter is studied from the point of view of the profit made, however, it is seen that it is economically possible to pay the night gang more money and ask less returns, and yet add to the company's profit.

For example, assume a shop to have a day pay roll of $1,000,000 per year, overhead expenses of $2,000,000, and a production of $3,000,000 above the cost of material. Then there would be no profit. If a night gang is put on at 10 per cent. higher rates than the day pay, with additional overhead charges equal to 50 per cent. of the former overhead, the cost of two shifts would be:

Day pay roll	$1,000,000
Day overhead	2,000,000
Night pay roll	1,100,000
Night overhead	1,000,000
Total cost except materials	$5,100,000

If it is assumed that the night gang produces 10 per cent. less than the day gang, their production would be $2,700,000, and the total production would be:

Production of day gang	$3,000,000
Production of night gang	2,700,000
Total production	$5,700,000
Total cost	5,100,000
Profit	$ 600,000

Thus there would be a profit of $600,000 where there was no profit before. Also, as a usual thing, a 50 per cent. increase in overhead charges for a night gang is unlikely, though there is almost inevitably an appreciable increase in the amount of spoiled work, and it is necessary to be even more careful about safety devices and safe practices than with the day gang alone.

Moreover, the employment of a night gang enables a small concern almost to double its product and more than to double its profits, without adding greatly to its fixed capital. In fact, since most manufacturers depend on their banks for carrying a large part of their working capital, the increase is not so much in actual capital supplied as in interest paid out.

The Three Shift Plan

Whatever advantages there are in a second, or night, gang in a shop apply to a third gang, provided that the efficiency of that gang is not too small, and provided that it is not necessary to pay too much to them as compensation for working at the most disagreeable hours of the twenty-four. In fact, the question of the third gang usualy hinges on the possibility of creating it. As an ideal, it seems as though the 24 hours were made to be divided into three parts, one for work, one for sleep, and one for recreation and private life. However, when the 24 hours are divided into the three shifts, it is inevitable that at least one of the shifts must work at a time usually intended for sleep. More than that, the division of the day into 8-hour shifts implies that each shift will work the 8 hours without rest periods and without food except as it may be bolted while working. With certain jobs that are of the watchman type, this is perfectly possible. Firemen, machine tenders, and workers of that type work but a small part of the time they are on duty, if the word work is used in its literal sense. They have abundant time to eat whenever they choose. But almost every skilled and even

unskilled workman has not only to be present and ready to work, but he has to work with his hands and brain, neither of which can he do and eat at the same time with any satisfaction to his stomach.

When three shifts are worked, they are usually made to run as follows:

Shift *a*..... 7 A. M. to 3 P. M.
Shift *b*..... 3 P. M. to 11 P. M.
Shift *c*.....11 P. M. to 7 A. M.

Shift *a* is the most desirable, attracts the best men, and is the most productive. The only hardship it works is in the case of men living at a distance from the shop where trolley cars or trains do not make suitable connections. Where the 8-hour day is prevalent, most shops open at 8 A. M. and trains are regulated accordingly, so that the shops that open at 7 are handicapped. From most men's points of view this shift is especially desirable, because it gives them a large part of the afternoon for recreation, gardening, and so on, without necessitating their shortening their evening by going to bed early.

Shift *b* is not so desirable, because it upsets the whole plan of the employe's life and he soon finds that he is working solely for the money for his family to spend, with very little chance to get any immediate benefit from it. If a man is single and has some definite object in saving all the money he can for a short period of time, this shift is an excellent one, because he has so little opportunity to spend his earnings.

Shift *c* is still more of a departure from the usual. The working hours are those when it is hardest to keep awake at all, let alone try to work.

Probably the happiest solution of the extra-shift problem is that found in shops where such processes as can be done by rather low-grade men, whose work is that of being present rather than doing skilled work, are put on the three-shift plan and where the highly skilled work is kept on the single shift, except in case of rush work, when the two-shift plan is used. Usually, it does not pay to run overtime with one shift if the working time exceeds 10 hours, except in the case of the watchman type of work. The 8-hour day has a great deal of fascination for workmen, especially if the shop runs 10 hours and they get time and a half for the overtime, thus getting the apparent bargain of an hour's pay for nothing.

A drawback to the two- or three-shift plan is found in the attitude of foremen, timekeepers, and other men of high mental

grade who are necessary to the success of either plan. They very naturally object vehemently to taking either of the disagreeable shifts, and they ask much more pay for taking them or, what is worse, accept them with the mental reservation that they will take the first "good" job that they can find. Labor turnover among such men is inevitably much greater than among the same class of men in the day shift. However, it is possible to pay them money enough to make life worth living in many cases and still derive a very considerable added profit from the extra gangs.

It is not to be expected that men can do a full day's work unless they have had a full night's rest, no matter how good their intentions may be. They cannot get a full night's rest merely by being in bed; they must sleep, and that is something that many men cannot do in the daytime without considerable practice. If there is a constant changing of shifts, men never become accustomed to the changes at all, and consequently they come to work sleepy, disgusted with life, and in a mood to listen to any Bolshevik propaganda that may be floating through the air.

Employment of Women and Children

From the employer's point of view, the advent of women in his shop is desirable if there is a lack of men to fill the places or if the women will work for less money than men. However, the cry now is, "Equal wages for equal work," which appears to be entirely reasonable but not always carried out, since women do not always contribute equal work even though they occupy the same places. A perfect method of rewarding men for their work should be equally applicable to women and should entirely solve this problem. In fact, any system of payment that recognizes the decrease in overhead charges, per unit of either work or men, which comes from rapid production, will be equally applicable to either men, women, or children, provided the women or children do not require more porterage or other contributory work to be done on their account.

It is, of course, to be recognized that women are not psysically adapted to do work which some men can do with impunity. The same is true in increased degree of children of both sexes. Women often make claim to physical equality, but the very fact that in athletics they never reach the same marks as men indicates otherwise, as there they have no restrictions other than physical to contend with. For this reason many states have passed legislation that restricts the hours that women and chil-

dren shall be allowed to work, and in some instances have restricted them so that they shall not work after ten o'clock at night, which makes them unavailable for the second and third shifts if such are used.

Whatever may come from future legislation, experience has proved that women can be found who will gladly do a great deal of the work that has formerly been considered men's work. Not only can they do it, but in some instances they can do it much better and faster than men. Every woman has her own individuality, so that generalities always find many exceptions, but usually it is found that women can do work that is of the same general nature as that which they have done for centuries better than they can do work that imitates that which men have done. For example, women do fine work requiring close attention, like the manufacture of electric meters and other measuring instruments. They make very much better inspectors on small work than men do, because they much more readily concentrate on it. They do not, as a rule, learn to do mechanical things, except in an imitative way; that is, they do not reason them out and rise to emergencies if necessary. They are not likely to learn to adjust machinery. Putting a new needle or a shuttle into a sewing machine is about the limit for many. There are of course enough exceptions to this rule to prove it, but in general it is not safe to expect them.

If a shop is what it really should be for the most efficient working, there should be no additional expense to putting women on the job, beyond that of partitioning off an appropriate number of toilets for their use. If the shop is filthy, it will be found necessary to make it clean before women of a desirable class will stay in it. If the machinery is not properly safeguarded, it will be necessary to attend to that. If the toilets are not fit for women, they are not for men, but men are not apt to say anything about the condition of toilets and they do not make their condition the major reason for leaving any one shop. It may be a contributory one, and it may be the last straw that determines whether the man will stay or go. In the case of a woman, it is very likely to be the reason why she goes and goes promptly. However, everything that women workers insist on is profitable to install for men workers, if the firm has the capital available to do it.

Training of Women Workers

Most men will at least pretend some acquaintance with the work they are asked to do. Sometimes it is only a pretense,

but in general they know something of it, at least from observation. Women are very likely to apply for work when they are utterly unfamiliar with shop conditions, to say nothing of the specific trade which they expect to practice. In fact, often they cannot make an intelligent choice because they are so lacking in information. Inasmuch as the great majority of women work purely for the money that they can get and not with the idea that they are going to make it a career, it does not make so very much difference what they take up, so long as they are mentally and physically adapted to it. For these reasons, the type of training that was known during the World War as the *vestibule school* is peculiarly adapted for training of women, even though it was instituted only as a war-time measure.

The vestibule school, as indicated by its name, is a means of entry into the shop. Instead of hiring men or women and putting them directly into the shop, to sink or swim as they may, they are first placed in a separate room in which are the typical machines of the shop and an instructor whose duty it is to teach a specific job to each new comer. Inasmuch as nearly all work into which women are introduced is in the nature of a single operation, or at most a group of very simple ones, it is easy to do this. No attempt is made to teach the reason why, the things which have led up to the job in hand, or to do anything except to teach the girl to do the thing the way the instructor tells and shows her. She stays in this room until she does her work with confidence in herself and until she gets accustomed to the noise of machinery. These rooms are usually built in the shop itself, and consist only of a partition high enough to shut out other and curious people. This latter is necessary only until the shop has enough capable women workers so that they do not feel timid in the presence of the more skilled workers. After that, the walls can be taken down and chalk marks on the floor substituted. However, as long as girls keep coming in who are entirely unfamiliar with the work, it is profitable to give them pretty specific training, if for no other reason than to teach them how to do the work in a way that is productive of results without being too tiring to them, and also to teach them how to accomplish the most possible with the least physical exertion. Left to themselves, they are likely to copy the most awkward girl in the room, and more than likely to acquire ideas of limitation of output that only reduce their own income without raising that of others. During the training period, it is probably best to pay day wages so that the girl will feel that she can give her attention to

learning rather than earning. The length of time that a worker should stay in the vestibule school is also very indeterminate.

There is a great difference in the mental aptitudes of different persons who are equally able to do a given job. In fact oftentimes people of high intellectuality find it very difficult to acquire a physical knack and require much more practice before they can be put on piece work than do those who have neither education nor the ability to acquire it. The fact that one girl acquires the "tricks of the trade" quickly and another slowly does not tell which will be able to earn the most money at the end of five years. The quick learner may be superficial, and may be one of those that finds every place she works so slow that she can only stay long enough to collect money enough to take her one more stage of her journey. The slow learner is much more likely to stick to one shop during her entire industrial life.

Much has been said about the instability of women workers. It is very true that women do not have such long industrial lives as men. Where men work at some industry or other for 20 or 30 years, women only stay 5 to 8 years, before they get married. On the other hand, experience has shown that the average man has something more than one new job each year, while the average woman stays 3 or 4 years in a place. For this reason, it is fully twice as safe to expend money in the training of women as of men. However, it is futile for a shop to start hiring women, to say nothing of training them, unless it is willing to put the shop in fit condition for them. There are of course exceptions to this rule, but they are only enough to prove the rule. Women whose morals are above reproach will not stay long where the working conditions are not good; their men folks will prefer to support them in idleness rather than have them work in insanitary places.

Office Organization

Usually more than half of the office force in a manufacturing plant is devoted to the production part of the firm's work. This includes the planning, the order, the cost, and the efficiency departments. All these departments employ typical office clerks and executives, who are of necessity familiar with the use of figures and the fundamental principles of bookkeeping. They also employ stenographers, typists, operators of adding machines of various types, in fact they use every device that is used in any other form of accounting. Therefore, any study

of production must necessarily consider the relation of these people to the shop itself.

First of all, it will be noticed that there appear to be barriers between the office men and the production men. The office force wear cleaner clothes while at work. They use better English, and they have on the average a better formal education than the production men. Therefore, the shop men imagine that the office looks down on them. Sometimes they are right, but more often than not the office man is envying the shop man his knowledge of a trade from which he can make more money than any one but a certified accountant can get in the office.

There are, however, always men who would like to jump the barrier from the shop side, because they see so many cases where the men in the office have gone into high positions in the organization. They find that in some places knowledge of business, and the ability to forecast the future has counted more highly than knowledge of the technical side of the manufacture of the product. When such a man comes knocking at the gate that leads from production to the office, he finds immediately that the office men get so much less money for their time that he cannot, or he thinks he cannot, afford it. Such a man finds his best entry into the office part of the work to be through the planning department, where his knowledge of shop work helps him to understand and straighten out snarls into which some man without that knowledge has thrown the shop.

The Planning Department

The planning department, in order to be efficient, must have in it men who understand manufacture thoroughly in every detail. No shop that allows its foremen or its employes to maintain secrets of the business by themselves can maintain a planning department and make it effective. Sometimes, in order to launch such a department well, it is politic to take into the department from the shop some man who is known to have secrets of his own and then set him to work ferreting out the secrets that other workmen have.

The office men are all paid out of the overhead charges against production, so they are literally a "necessary evil" from the shop standpoint. However, they are necessary. The problem is not only to secure as great efficiency in office work as possible, but to be sure that no unnecessary work is done. That is, records that cannot be of use should not be made. Periodically the work of all the office departments should be gone over and the work that they do set off against the probable returns

that may come from it. A planning department can be imagined that would plan the work thoroughly and make it come through the shop smoothly, and yet keep no records whatever; but, unless records are kept, the head of the department will have to be kept on the job indefinitely, no matter what provocation for his dismissal there may be. There is likewise need of records of the rate of progress of each job, so that the rate for the next job may be checked up and the errors made the first time it goes through avoided the second time.

Record Keeping

In order to keep records, there must be a force large enough to keep them up to date, else the records become historical only, and of very much less value than they might well be. Consequently, there is no profit to the company in stinting the number of people on the office pay roll, provided there is necessary work to keep them all busy. The same reasoning applies to the executives of the office force. The mere ability to keep some semblance of order and to see that every one is putting in full time is not enough for any of these executives. They need to be men capable of organizing and of improving on organizations. Of course, improvements in organization and methods may be effected by bringing in a consulting specialist, but he cannot be kept on the job constantly, and the men in the organization itself must be the ones to put into effect the plans that the consultant may suggest, if such plans are to be the active force in the work that they should.

Moreover, there is need of a central head in the office, who will see to it that there is no duplication of effort through jealousies or through ignorance on the part of one department head of what records another is keeping. Too often, jealousies cause a department to withhold information that another needs, and make it necessary to have clerks employed getting the information from its original sources, or one department may purposely keep certain information in such a form that another department may have to reclassify it entirely before it can use the information. These things can be straightened out by a central executive, the office manager, if that name is acceptable, or by any other official who has the authority to delve into the records of all departments.

Conditions similar to those just mentioned may exist because of lack of interchange of ideas between departments. Often departments grow up and get so large that their heads have no time to look around and find out what other departments of the

office are doing. This is an unfortunate situation, but there is no certainty that such heads will look around, even if enough assistance is given so that they have time. Habit is strong. The office manager, however, is known to be responsible for inequalities between departments, and no resentment is usually shown to his inquiries where there would be if another department head were to make the same inquiries.

From the viewpoint of the production department, almost all office activities tie up with some other work. It is necessary to keep records of men's time for two purposes, one for the pay roll, the other for cost keeping. The employment department is concerned as to their attendance and their promotion or demotion. These departments cannot be considered as independent units, but must all work together. The same is true of the planning, the efficiency, and the order departments, and so on through the office work. Standardization of the working conditions in the office departments is also necessary. Many shops treat their timekeeping departments like the shop workmen, the cost department as purely an office force, and the planning department in between the other two. In point of hours there is need that the timekeepers be on the job while men are working, no matter how long, and part of the planning department is needed whenever any of the work they have planned is running, just as an operative is needed even when an automatic screw machine is running smoothly. But there appears to be no reason why the conveniences and comfortable working conditions of the office force should not be shared by all of that force, regardless of whether their duties take them into the shop or around the yards. It is well understood that the office force draws less pay for a given time spent, usually because it receives more of the non-financial rewards than the shop men. That is, the office men have more comfortable working quarters, more vacation, better toilet facilities and more of the refinements, and longer tenure of job; although this last is apt to be because they are willing to stay rather than that the management is any less anxious to have a low labor turnover in the shop.

Training of Office Workers

It is undoubtedly a profitable thing to establish a definite plan to insure that every office worker shall become acquainted with his or her job, what it is for and what it leads up to, rather than to drop them into vacant places in the force and trust to luck that they may find out from others how to do their work as is required. Office people will average of higher intelligence than

the shop, if we leave the higher executives of both out of consideration. This is unfortunate for the shop, but comes about through the use of machinery that makes possible the employment of men of less intelligence in the shop. The office people, however, cannot know what is required of them until they are told. Telling them a great many details all at once is not economical, because no one can comprehend a great many new details at once. Time is required to assimilate them. The assimilation is much more thorough and easy if the new employe is told why each thing is done as it is, what has gone before it, and what follows it. This is readily done if it is the business of some one to do it. Often it is well to place a new employe in the departments whose work precedes the one into which he is ultimately to go, and possibly in the one into which the results of his work must go; in this way he will learn to have a respect for the people who do the other work and to have a sympathy for them whenever things go wrong for a time. Business men complain that they constantly receive letters, bills, and orders that indicate on their face that the persons who wrote them are not acquainted with the work about which they are writing. Such experiences should teach employers to give their own employes the opportunity to know enough about their business so that they can act intelligently about its details.

METHODS OF SECURING COOPERATION

The Workman's Part in the Organization

All that has preceded has been written from the standpoint of the organization methods which have become standard. Recently another phase of management has come into prominence, not so much because of the great number of firms that have taken it up, as because of the prominence of the few that have gone into it seriously. This movement has various names, industrial democracy, shop committees, profit sharing, and so on. They all are an attempt to find a way to take the employe into company in the business at which he works. The reason for this attempt is in some cases the pressure of labor unions, in others the fear of the pressure that they might exert, in others purely a desire to do the right thing, and in still other places a desire to make all the profit possible, even though it be by appearing to give up more of the profit to the workmen.

Fundamentally, every one concerned in production, whether he is a stockholder, a director, an official, or a workman, is dependent on the good management of the firm. If the firm is

prosperous, there should be enough profit for every one. Healthy growth of the country or any community depends on there being enough profit to go around, and on its being passed around. Business cannot be obtained under normal conditions unless the firm is in a position to manufacture at least as cheaply as its competitors. Business cannot be held unless the firm can manufacture as good goods as its competitors. Neither of these things is assured unless the workmen and the whole organization are in harmony and every one feels satisfied that he is with the right firm.

Distribution of Stock

The first attempts to secure cooperation were in the form of profit sharing, a course that is lined with the wrecks of firms that have attempted it. The difficulty in profit sharing arises because the profit distributed becomes a gift, no part of which can the workman trace to his own efforts, and in which he has no share other than as an acceptor. The thing which more recent experimenters have tried to do is to make the employe responsible for something or other that would definitely tie him up to the business and make him see that its success depended on his own and other men's exertions.

These attempts have crystallized in two prominent forms, one the distribution of stock in the company, the other the shop committee. The distribution of stock is not usually intended to give the employes any considerable voice in the management, or at least not to give them much voice for a long time to come. The most notable example of this plan is the stock distribution of the United States Steel Corporation. Ultimately, it is possible that the entire stock of a corporation might get into the hands of its employes; but such a probability is not great, even when workmen are given every chance to buy on the instalment plan and at low rates. For that matter, there appears to be no reason why employes as stockholders should not be a welcome addition to any company, regardless of whether they become so through the wish of the management or through their own initiative. The only way they can get stock is by paying for it in one way or another. The wisdom of such a move is more to be questioned by the men themselves. They, as individuals, can hardly be expected to secure enough stock to make each one a power in the company, and therefore from a purely economic point of view it is wiser for them to scatter even their small investments among several strong companies.

Consideration of the question of stock distribution should

be based on the kind of stock offered and its privileges. In general, there are three ways of financing a corporation. The first, through issue of bonds, which are really notes issued for borrowed money, bearing definite interest and having a definite due date when they must be paid. The second, by issue of preferred stock, in exchange for which money is loaned to the corporation and on which a definite interest rate is set, but the principal is never due. The only way the capital investment in preferred stock can be realized is by sale of the stock to some one who is willing to buy. Preferred stock may have voting powers or not, according to the agreement under which it is issued. The third method is by common stock, which represents money invested in the company, but which takes its chances of return of both capital and dividends according to the prosperity of the company. It is usually voting stock.

Of these, it is seldom if ever that employes are purchasers of bonds. Preferred and non-voting stock seems to have no particular attractions. It is the common stock, voting or non-voting, that is of consequence. This is the stock that takes the large risk, and which also can pay large profits. It represents the gambling element in business. Good management and cooperation make for a profit; poor morale and confusion make for loss. The condition of the times also may make for a loss. In many firms, however, the common stock does not represent any money investment. Its value is dependent, not so much on what it might bring if the company were liquidated, as on the probability that it will pay dividends. In normal times a stock that has regularly paid 6 per cent. dividends for a long time and of which nothing is known that will prevent its continuing, is worth par irrespective of whether or not it cost the original owners more than the paper for printing the certificates. If the company is one that has no intrinsic value in its common stock, printing and distributing shares is merely giving out a share in prospective profits. The common stock is seldom assessable; consequently, the only way it can share in losses is by foregoing dividends, or by a fall in its market price. However, if this stock is placed in the hands of employes, the fact that its dividends vacillate according to the conditions of the times is enough to give them a very lively interest in its value. The usual method of distribution of such stock is either by outright gift, if there is no intrinsic value, or at a rate which is somewhere between its book value and the market value in normal times. When common stock is given to employes it is likely to be voting stock, but with the proviso that in case the employe

severs his connection with the company the stock shall either be bought in at some agreed price, as the market price, for example, or that it shall be exchanged for non-voting stock. There is no apparently good reason for doing this, unless it is that the company feels that it is making a gift to its workmen. Gifts in business are bad, and particularly so between employer and employe.

One notably successful enterprise has for a number of years given all employes whose pay was above a pre-war level of $1,200 a year, shares in their company in such a way that the actual management is for the time being in the employes' hands. The company reserves the right to have the voting power revert to the holders of preferred stock at any time that losses take the place of dividends. This way is fairly safe for the company, and at the same time gives that element of the employes who are in the best position to make the stock profitable the best opportunity to express themselves and to make the business what they would like it. It seems as though some plan modeled on this idea is really necessary to any kind of stock distribution; for there are always many employes who are unable to understand the intricacies of business, and who are better off not to try. Moreover, it helps to put the line of cleavage between the managerial class and the workman's class lower down the scale. It is unfortunate that a line of cleavage should exist; but since it does, the only way to get rid of it appears to be to push it down and down until it ultimately reaches the bottom. Under the ordinary form of organization, very few under the rank of foreman belong to the managerial group. Even the foreman has very little opportunity to know about the business itself, but is merely forced by his position to side with the management on a great many matters in which his sympathies may very well be with the common workman. By bringing all the employes whose work requires high intelligence into the management, there becomes a much larger group who are responsible for wages, working conditions, and so on.

In order fully to accomplish this result, however, it appears to be necessary not merely to put voting stock in the hands of employes of the higher grade, but automatically to give them a voice in the management. This means literally what it says, a *voice* in the management. It means that they have the opportunity of presenting their views on any subject that affects their relations with the company directly to the management, with the expectation of consideration and a reply.

Shop Committees

For the purpose of giving the employes an opportunity of expressing themselves in the management, shop committees have in some cases been formed. Some of these have come about through the distribution of stock and more through a feeling that some such opportunity ought to be supplied. The shop committee is also looked on in some quarters as an endeavor to substitute a controllable union within each individual shop for the present form of unions. This may be the idea that is most attractive to some employers, but it is not necessary to consider this as the controlling factor.

The wisest attitude in regard to the matter of shop committees may perhaps be better seen by considering carefully the relations between the employer and his employes. In general, the employer has somewhat the advantage of position. He furnishes the capital, which consists of savings, his own or some other persons', and without which the business cannot be started or continued. In the case of a large corporation, this capital is the accumulation of the savings of thousands of different persons. If most of these have themselves been wage earners, the company is likely to have a management that is fairly disposed toward its employes; if the larger number of stockholders have inherited their capital, or if they have won it by speculation, or if they have simply borrowed it, there is more danger that they will have labor troubles. This capital is however absolutely essential in order that the business may start at all. It is equally true that business cannot be carried on without the necessary labor; and if labor is lacking for any reason the business will fail and the larger part of the capital will be wasted. This lack of labor may be on account of poor judgment in the location of the plant, it may be due to poor working conditions, or low wages, or long hours, or to any one of many reasons, including strikes, union or otherwise. However, capital is wary, and it will not invest in a town where strikes are habitual. Nor will it invest until it is satisfied that that particular place affords a good chance of making a profit on the money invested. The day when a shop is located in a town merely because some one man lives there is rapidly going by. If a town is known to have an element of unrest, it is shunned by firms that are well enough acquainted with business to know how much strikes cost.

It is safe to say that the firms that have entered on a plan of shop-committee organization have really done it as a form of insurance against strikes. The plan has not always worked

out as expected, but it appears to have its advantages, and to all appearance there seem to be more advantages than disadvantages. It is likely that a proposal to install a shop committee plan will create suspicion on the part of the employes, but for that matter so does every move on the part of the owners of a shop. The fear is of the unknown. The plan has not yet been thoroughly tried out, but experience will show whether it is adapted to general use or to what kinds of manufacture it is applicable.

Effect of Shop-Committee Management

The first effect of a shop committee is the same as the installation of a suggestion scheme. Every man in the shop who thinks away from the normal immediately makes suggestions. Among them there are sure to be some good ones, which should be carefully winnowed out. The next thing likely to happen is an attempt by the men who belong to organized labor to secure places on the committees and then to get other men from their organizations on. For this reason, great care should be taken when a committee system is installed for the sake of breaking up the influence of the unions. It will be much better for the shop-committee movement if all the first experiments are made in open shops, so that the plan can be worked out where it will have a chance of a sympathetic hearing.

In any event, the test of the system is in whether it makes men more tolerant of each other, and whether it is carried out in strict honesty. There is no escape from the fact that labor unions have nearly always been forced by the employers to adopt a fighting policy, and to elect a fighting delegate. Since "all is fair in love and war," and the unions at least consider this war, it is no wonder that there are many things done by both sides that each ought to be ashamed of. But it seems as if when men who are interested in the same problems sit down together, it should be possible for them to come to such an understanding of each other that they will grow to have confidence, and not suspicion; and it is usually suspicion that promotes or provokes the hatred that is so often in evidence when the representatives of workmen meet their employers. The committee system would seem to be a way to bring all potential disputes out in the open before they become aggravated and a source of violence.

The two problems of high labor turnover and strikes have been classified as one by calling the high labor turnover an individual strike, which it is in a great many cases. That is, the

workman goes out from the shop in which he was working for the same reasons that a large body of workmen go out in the case of a strike. In fact, it takes more courage to throw up one's job as an individual than to do it as part of the whole shop force. However, the individual striker is more subject to argument and can be reasoned with, where there can be no reasoning with a large number.

It is almost safe to predict, however, that the time is coming when men will not be employed until they have been examined by a mental specialist who can say with considerable certainty whether the candidates are likely to become cooperative parts of the organization, or whether they must from their own dispositions always be antagonistic to order and to cooperation. There are not a large proportion of this latter class of people; but it seems that it would be for the good of all of us that they be segregated and not allowed to influence others with whom they are now thrown in contact. These people will in their own defense cite the action of noted reformers of the past and the good which they have started, but they overlook the fact that the non-cooperative type of reformer has almost always been consumed by his own fire.

PERSONNEL

MERCHANT MARINE SCHOOLS

A canvass of individual seamen among the militant maritime unions of the New York area disclosed that the Government's new merchant marine school, once the object of bitter protests from organized sea labor, has been accepted by the unlicensed personnel with only slight reservations.

Existing buildings on Hoffman Island have been repaired and the school has been outfitted with modern galleys, dormitory facilities and sea training equipment.

Seamen said that their primary objection to the training school, when it was first proposed, grew out of their fear that it would create new seamen and add to the serious unemployment problem among maritime workers.

For the present, however, the Government has decided to limit enrollment to unemployed seamen with at least two years' experience, and this program will serve to take jobless men away from the waterfront, clothe and house them, and provide pay of $36 per month.

The schools, including later ones to be established along the Gulf of Mexico and on the Pacific Coast, will be administered by the United States Coast Guard, although each will have an executive officer drawn from the civilian field, probably from the merchant marine. An officers' school is to be organized at New London, Conn.

Rear Admiral H. A. Wiley, U.S.N. retired, a member of the Maritime Commission, said that the Federal agency considered properly trained crews as important to the maritime reconstruction program as the replacements now being ordered for the nation's depreciating merchant fleet.

"In the past," he said, "we not only failed to make replacements, but we took no steps to give the men who man our ships proper training such as other nations provide. The United States Coast Guard and the school ships maintained by various States have been training officers, and have turned out some splendid men, but there is not a single training school for seamen in this country. There is no question but what a large part of the personnel problems with which we are contending on our ships can be directly traced to our own neglect in this respect."

GROWTH OF MERCHANT MARINE

A prospectus of the data and statistical tables in the new Lloyd's Register for 1938–39 covers the entire development of the

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world's merchant marine fleets since 1901, the period which saw the greatest growth in the annals of merchant shipping. During this time total steam and motor tonnage of the world increased from 24,009,000 to 66,870,000 tons.

Since 1914 the increase in tonnage was 21,466,274, equal to 47.3 percent of such tonnage in existence in the years of the great war. The greatest increase in percentages took place in the United States, and the most striking decrease in Great Britain and Ireland. German tonnage also declined from 11.3 percent of the world total in 1914 to 6.3 percent this year. Great Britain and Ireland owned 50.2 percent in 1901, 41.6 percent in 1914 and 26.4 percent this year. United States percentages for the same years are 4.2, 4.5, and 13.4. Japan in 1901 owned 2.2 percent of the world's mercantile fleets, increased to 3.8 in 1914 and 7.5 this year.

In 1914 Great Britain and Ireland had 8,587 vessels with a total of 18,892,000 gross tons, against 6,843 ships in 1938 with a total of 17,675,404 tons. The United States had 1,113 vessels in 1914, not counting ships on the Great Lakes, representing 2,026,908 gross tons, and had increased the fleet by 1938 to 2,338 ships of 8,936,465 tons.

PERSONNEL OF ACCOUNTING FIRMS

Credit men will probably henceforth require greater caution on the part of certified public accountants against the possibility of defalcations or falsifications by their employees, as a result of revelations made by the S.E.C. after it had conducted an examination into the affairs of Interstate Hosiery Mills. The testimony related to the methods of conducting the audit and of reviewing the work of the assigned auditor, who is now in jail. It brought out that safeguards are usually taken against defalcations, both in the employment and advancement of individuals, and through use of a system of rotation, by which different men are ordinarily assigned each year to the auditing of an individual account.

The latter principle is widely accepted among credit men and auditors as a method of insuring against falsifications or temptation to an individual employee to yield to any pressure from executives regardless of circumstances. Credit men said, however, that it is "more often observed in the breach," since it involves additional expense for an auditing concern. A man familiar with an account, it was pointed out, can handle the work more rapidly than another equally capable man who is not familiar with it. By continuing to assign one certain individual year after year to

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the audit of the same accounts, a considerable saving in time, and therefore in expense, is possible.

The testimony was of a hypothetical nature, in that it was asked what conditions should surround approved auditing and practice and procedure. In this connection it was testified that if a reviewing partner of an auditing firm is assured by ordinary tests that a supervising senior, such as the one in question, is of the character and attainments necessary to the work, then he is justified in assuming that the man is not a Benedict Arnold, and is, therefore, no more culpable than was George Washington in assuming that his trusted military assistant was not "double crossing him and the nation."

The principle of rotation would, obviously, prevent the type of fraud in question from going undetected. Such a procedure, however, would be objected to by clients who preferred as their auditors men familiar with their affairs, aside from the economy involved. It is the only technique ever deemed necessary to meet a situation such as that created in this case, a situation without parallel in all accounting history.

Both credit men and accountants were concerned over the possibility that testimony at the S.E.C. hearings might cause questioning of accounting methods. Credit men said, however, that they saw no indication that accounting concerns could do more than adopt tighter methods of checking on their employees, and their only suggestion was a greater use of the rotation method.

VOCATIONAL TRAINING IN THE CCC

The Civilian Conservation Corps, set up by the Roosevelt Administration to take idle youth off the street corners, found jobs in private industry for one third of its entire enrollment in 1937, according to the CCC educational director, Dr. Howard W. Oxley. In 1937, 90,000 young men were taken off the Federal "forest army" payroll and put into private employment.

Credit for this accomplishment has been given to programs evolved in each of the 1500 CCC camps in the country. From his first day in camp, the educational director said, each CCC member is made conscious of his occupational training needs. Camp educational advisors keep one eye on his guidance and the other on his ultimate placement in a permanent job.

Of the 90,000 youths discharged from the CCC for private jobs in 1937—31 percent of the year's enrollment—38.6 percent were actually placed through the CCC program. The remaining

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61.4 percent used what they had earned in camp to find jobs by themselves, through relatives or friends, the employment service, a community civic agency, or some similar source.

The division of the jobs obtained was: In agriculture, 29.4 percent; in manufacturing and mechanical industry, 19.7 percent; in transportation or communications, 12.1 percent; in business trades, 10 percent; lesser numbers in mining, clerical positions, forestry and park service, and domestic service. Not only was "basic training and practical experience in nearly all of these occupations" available in the CCC in 1937, Dr. Oxley asserted, but, he added:

"CCC officials contacted approximately 18,000 former enrolees during 1937 to ascertain their condition and employment status. It was found that 55 percent of those contacted were employed in either regular or part-time jobs, and of this number approximately 42 percent had entered jobs for which they had received basic vocational training in the CCC."

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LABOR

The standards of labor for the first half of 1935 were comparatively high and comparatively stable. The pickup in industry was reflected by an increase in wages. Strikes were common and there were a bit more than last year, though their cause has been attributed in part to the fact that employees feel they should get a higher wage as a result of the noticeable industrial improvement. Labor conditions in the textile industries were falling far behind and, in fact, many textiles were shutting down or dropping employees. The Government even went so far as to make an earnest appeal to restrict production in this industry.

The NRA decision, as noted elsewhere, created a sudden lapse among certain industries in the high standards formerly kept. The textile industry was temporarily the most hard hit. Employers, either by voluntary trade agreements or individual statements, upheld for the most part the conditions of wages and labor necessitated by the codes. The textile industry joined the rest, and, by September, it was leading all industries in the percentage of adherents to labor standards provided for by the codes.

The American Federation of Labor has been very active and very optimistic. Its President, in a speech at Canton, Ohio, on September 2, 1935, asserted that labor is demanding and will get a thirty-hour week with high wage payments. In the organization bulletin published September 8, the A. F. of L. predicted that the last four months of 1935 would show a further improvement in business conditions and that the country should arrive at "the highest level of industrial operations" since 1930. Present indications of improvement, went on the report, are not based on Government spending but on noted gains in private industry. Eleven million workers were found unemployed, however, and the organization declared that it could not expect an upward trend alone to put these men back at work.

The A. F. of L. has carried on an extensive campaign, this year, to unionize the automobile industry. The entire industry embraces 250,000 workers, but 60 per cent are still unorganized. Father Coughlin has instituted an automobile labor union of his own which includes 26,000 laborers, most of whom work in Detroit. This organization, known as the Automobile Workers' Association, is actively opposing the A. F. of L.'s step into the automobile industry. The latter's organization, the International Automobile Workers' Union in Detroit, was given a charter by President Green of the A. F. of L. and boasts a membership of 35,000.

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The A. F. of L. would include all part workers and all production workers, except members of craft unions.

The National Labor Relations Act

The Wagner-Connery Labor Disputes Bill became law in July. Its provisions, for the most part, were not unlike the act it superseded. Two major features are of special significance. First, the National Labor Relations Board (which had been established by an Executive Order of June 29, 1934) has been made a permanent independent body. Its function is to preside in an administrative quasijudicial capacity over all labor disputes as they first arise; and, if no settlement is reached, to send the dispute on to the courts. The real task of mediation and conciliation, however, still lies with the Department of Labor. The Board consists of three members, appointed by the President for a term of five years. The members are not removable except for neglect of duty or malfeasance in office. J. Warren Macklen has been made its chairman.

The second main feature of the Act concerns the much discussed collective-bargaining right. Without this, it is believed strikes and other forms of labor unrest are likely to occur. Such friction is considered a burden to interstate commerce, and hence the Government feels that the provision is constitutionally justifiable. The collective bargaining provision in the Labor Act is not unlike Section 7(a) of the NRA code but, whereas the latter was considered merely a statement of policy optional with the Federal Government, the provision in the Labor Act is to be enforced throughout the land. There is the essential difference, however, that the Labor Act provision is apparently made applicable only when interstate commerce is involved, and is thus cleverly phrased to meet Supreme Court objections. Accordingly, "employees shall have the right to self-organization, to form, join, or assist labor organizations, to bargain collectively, through representatives of their own choosing, and to engage in concerted activities, for the purpose of collective bargaining or other mutual aid or protection."

The term "employee" is so defined as to include "any individual whose work has ceased as a consequence of, or in connection with any current labor dispute, or because of any unfair labor practice, and who has not obtained any other substantially equivalent employment."

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PERSONNEL

General Considerations

THE number of employes required for a production of a given value varies greatly in different shops. The more refined the product the larger is the pay roll compared with the invoices of materials. For example, many more persons will be employed at a higher expenditure of wages in making iron ore into automobiles than in simply smelting it in a blast furnace.

Thus the problem of labor, including every grade of physical and mental laborer, is of varying importance in different shops, depending on the conditions that surround each.

In general, however, it is safe to say that nearly everywhere the flow of labor from shop to shop is too free for the good of either the shops or the employes. The problem of reducing this flow is the problem of the personnel department, no matter under what name it may appear on the particular organization chart.

It is only within a very few years that the labor flow has been recognized as a problem at all. Previous to that, it was a commonly accepted opinion that the flow of labor was inevitable and that it was a misfortune due entirely to the fault of the employes. Moreover, since the cost of training new employes is entirely concealed so far as any cost accounting shows, the expense due to this rapid flow of labor was not appreciated.

Personnel Work as a Part of Production

The old saying, "Well bought is half sold," applies quite as well to labor as to materials. The greater part of all the materials used in manufacture can be stored away through times of depression and used on a rising market quite as well as at the time of purchase. On the other hand, every day during which a man does not work has gone and can never be recovered. To be sure, up to a reasonable amount, time must be allowed for recreation as well as for sleep and meals; but, in general, each man lives and does his work by the lifetime rather than by the day or week. His life is not necessarily prolonged by vacations or by lay-offs or shut-downs; so it is safe to say that everything that decreases the number of days he works each year is not merely a loss to him but a loss to the community as well.

The personnel worker then has a real part in manufacture, just as important as that of the purchasing agent, up to the time the employe goes to work, and just as important as that of the superintendent in charge of machinery and equipment, after the employe is on the job; and at the time the employe leaves the personnel man has a still more important function, that of discovering the reason why the man left and of finding a way to stop that particular leak if possible.

Personnel Work Relative to the Management

The personnel work is an essential part of management, for it has a large effect on the cost of production. In too many cases the management has gone at it half-heartedly by either hiring some man known for his "big-brotherly" attitude, or because he was a psychologist, or sometimes because he was a relative of the manager and had to have a job. These men have been thrown on the job to sink or swim. Many failed, not so much on account of the method by which they were selected, as because they had no real backing from the management.

Since personnel work is a problem of management, it would seem as though it should be under and very close to some member of the firm or corporation who will give very liberally of his time and energy. This does not mean that the head of the department can be a figurehead, but that the policies of the department become and are the policies of the management. Unless this backing is extended by the management, there is absolute need of a very strong man in charge of the employe-relations work. To be successful, he would need to be a stronger man than the general manager, because he cannot throw any of the safeguards and protections around himself as can the latter. He has to be out in the open and ready to defend his position at all times, whether against a foreman or a disgruntled workman or against a superintendent, for he becomes the center around which some very vital matters concentrate.

That it pays to have thorough personnel work done is evident; for it has been demonstrated many times over that such work can hold the labor turnover of almost any kind of a plant well within the 100 per cent. mark, while it is not at all uncommon to find labor turnover running as high as 250 or 300 per cent., and during times of great unrest double these figures have been common. At the same time, and during the height of the unsettled conditions, firms have maintained labor turnovers of 60 or 70 per cent., when other firms next door to them

and operating without a personnel department were having ten times the turnover.

The cost of labor turnover is always problematic, and investigation of the amount involved brings employers face to face with astonishingly large figures. Take, for example, the case of a shop employing 5,000 people and having a labor turnover of 300 per cent. If the average cost of training an employe is only $50 and the turnover can be cut to 100 per cent. by proper care, it is evident that there is a possible saving of half a million dollars. However, the very magnitude of the possible saving makes hard-headed business managers feel that there must be something wrong about the statement, very much as a banker is suspicious of an investment that promises over 10 per cent. dividends. The business of the world has been conducted much more wastefully, so far as labor is concerned, than in respect to materials and methods of production. Shop after shop has figured its efficiency, measured in terms of speed of machines, automatic machinery, etc., in most minute terms, and has watched every avenue of loss except the large one of inefficient labor. If an employer buys 100 tons of pig iron and only produces 90 tons of castings, he realizes the loss and makes every effort to minimize it; but if he buys $100 worth of labor and only gets 90 per cent. of the returns that he might if it were not for the expense of training new workmen, he does not realize it, because it is a condition to which he has always been accustomed.

Progress of Employment Work

For the reasons that have been outlined, work for employes, such as would lead to decreased cost of production, has not made very rapid strides. It has suffered the handicap of beginning as so-called welfare work, which was paternal and more or less advertised as philanthropic. Employers vied with each other in telling how much they were doing *for* their help. They had dances, rest rooms, promoted athletics, had lectures on home cooking and hygiene, offered to invest employes' savings for them, and in many other ways did things which appeared to their employes as being strangely philanthropic, and which made the latter feel that if the company was making sufficient profit to do these things it could better have increased wages. This kind of employe-relations work appeals to a very considerable class of workmen, and especially work women, and cannot be neglected by the student of modern methods; but there is little room for doubt that it did slow down the progress which the movement toward a more efficient personnel might have made.

It was based, to all appearances, on a misapprehension on the part of employers as to the intelligence of their employes. Inasmuch as the matter of personal intelligence recurs in other relations with workmen, it is well to give it careful consideration.

Intelligence of Workmen

The average workman in skilled trades is about as unbusinesslike as the average college professor, doctor, or minister. That is, he presumes that all other people with whom he deals will be as honest as he is in his own interpretation of the word honesty. The workman expects, when he is hired by a new employer, that he will have the benefit of whatever has appeared to him to be the customs of the trade which he follows. He is very apt not to inquire into what the customs really are, but to accept what is offered. That is, he may go into a town where the rate for a skilled machinist is 90 cents an hour and he may accept 70 cents for quite a long time without knowing what to believe is the going rate. However, it is not safe or right in either case to assume that because the workman does not demand the returns which he should have, or does not, except when he acts in unison with others, have the courage to stake his job against his future, that he is unintelligent. Nor is it safe to assume that education is definitely connected with intelligence. A man may be entirely unable to present his case in convincing English, he may be timid about presenting it at all, and yet be entirely capable of understanding the purpose back of paternalism.

Relation of Personnel Work to Foremen and Superintendents

Even though the management extends its best support to all the things the personnel department does, unless the work of the department has the sympathy and support of the foremen and superintendents it will not meet with a full measure of success. Hospital care, safety engineering, employment work, follow-up, all to a certain limited degree take away from foremen certain prerogatives which they have formerly exercised. No one, no matter how burdened, cares to be relieved of any duties, if such relief tends to decrease his power or his apparent standing over other men. Good employment management selects men suitable to the work, assigns them to certain foremen, and transfers them as the exigencies of the business demand. Good safety engineering takes away from the foreman the right to order a man to use machinery that is dangerous, and stops machinery from being used at all until put in safe condition.

Good medical care tells a man when to go home and how long to stay there, with little regard to the pressing needs of the shop.

It is essential to the greatest profit over a long period of time, that the right man be put in the right place, even though the foreman in charge has personal antipathies against him. It is necessary to the greatest profit, that the work of a man for months shall not be offset by the loss in money and in production due to an accident caused by the carelessness of a too zealous foreman; and it is necessary for the sake of future production that a man should not be allowed to prolong a slight cold or headache into a long illness, through lack of consideration for his health. It is, however, too much to expect that any one man can be a specialist in production and at the same time a specialist in employment, safety, and medicine, not to mention many other functions of the personnel department.

It will undoubtedly take many more years for a new crop of foremen to grow up who are willing to accept this specialized assistance in the spirit in which it is given. A few of the older foremen understand the conditions clearly, but many do not. In some shops they have had each of these things, so to speak, thrust down their throats, with only the briefest sort of explanation of the objects to be attained. Very often it happens that the directors and general manager, who are apt to be better informed of what their competitors are doing, decide on these innovations and insist on their being tried out while the works manager is yet unconvinced and is only biding his time to discover flaws in the details of the plan, which he will magnify into mountains of discontent. It is, therefore, very necessary for any one contemplating employment in a personnel department to find out in advance what the relations are between the department and the foremen. With the support of the foremen he can accomplish a great deal, but if they are opposed, or worse still, if they damn it with faint praise, he can depend on having an up-hill fight.

Relation of Personnel Work to Employes

In many ways the personnel department is an interpreter of the views and wishes of the employes to the management. Most labor troubles grow out of relatively small misunderstandings. They may be intensified by outside influence, but the seed of discontent is very often within the plant. It is part of the duty of the personnel department to be so much in the confidence of the employes, and rightfully so, that they will bring all these petty troubles to that department rather than let them

grow into big troubles. This condition of confidence is not easy to arrive at, because many of the things that employes will ask for cannot be done and are not conducive to production. Then, the people who are the most apt to bring their troubles out for an airing are not necessarily the ones who most fully represent the real feeling of their fellows. The real feeling can be discovered only by knowing a large variety of the workmen, including those who do not seem to desire to become acquainted. As a general thing, however, the departments like the employment, safety and hospital, which are apt to irritate foremen, are likely to be accepted by the men themselves, especially after they become familiar with the working methods. For example, almost any man can realize the advantage to him of making application for jobs where all the openings in a factory are known, rather than where he can see only one foreman who may know nothing of the needs of his next-door department. He can also realize the comfort of having a good place to wait for attention. He may wonder what need there is of the searching inquiry that is made regarding his past, but he is very much used to this now and does not resent it. He appreciates the value of a safety department every time he sees that the department insists that machines shall not be used when they are not in safe condition, unless he is on piece work, in which case he may resent the interference. He recognizes the value of the medical department every time he sees a man who has been hurt or taken sick come back into the shop well cared for and pleased with the treatment he has had. The employe may have resented the physical examination through which he was put as an applicant; but, if his natural fears have not been excited during the examination and the physician has some words of kindly advice to give him in addition to the report which he makes out, the advantage of working where there are such facilities becomes apparent. It is a matter of experience, that men are much more impressed with these things than they are with some of the more purely welfare work that is done. They appreciate housing also, when it is done on a scale that seems sensible, also transportation, feeding, cooperative buying, and mutual benefit associations; but they appreciate them more if they have some hand in them themselves. Employes realize that there are things which demand experience along technical lines and for which the company must necessarily take full responsibility, and for the doing of these they have true appreciation.

Ideal Relations Between Employers and Employes

The older ideal among employers was for the employer to be a perfect father to his workmen and to direct them so that by thrift and economy they would some day acquire sufficient money to buy out the business and he could retire on his fortune. This attitude, however, presumes a very great confidence in his own infallibility on the part of the employer, which, however, was not lacking a few years ago. The older ideal among workmen was a good steady job paying an always slightly increasing wage, a job that did not leave them so tired at the end of the day that they could not enjoy their evening. It is only comparatively recently that business men have begun to realize the need of specialists, and to call them in.

Present-day ideals, not by any means reached, call for such a relation between employer and employe that both will work for the greatest possible production with the least tie-up of capital, consistent with work of the grade needed, and consistent with the comfort and long life of the employe and the reasonable life of the equipment.

This relation can only be brought about when both workmen and employer have equally attractive incentives to bring it about. Just so long as either believes that the other is making more than his share of the profits this new ideal cannot be attained. A knowledge and belief that profits are rightfully divided is the foundation on which almost the whole matter rests. The profits which an employer makes may be wholly a matter of conjecture on the part of the employe. He may judge, because the manager continues to use his limousine when he is saying that business is flat, that the latter is untruthful. Judging from his own experience, the employe may not be able to see how any one can be other than broke or flush; he cannot conceive of another man's having a reserve fund with which to equalize his living conditions, adding to the reserve when times are good and eating into it when they are bad. To the mind of the workmen the ostentation with which many successful business men and their families live is a constant reminder of the things which workmen cannot have.

Limitations of a Personnel Department

Ideals cannot be reached in a moment. The fact that the management have high ideals and are willing and anxious to put their relations with their employes on a high plane does not necessarily make it possible to put those ideals in operation

at once. This is very annoying to the type of general manager who has surrounded himself with people who do his bidding at the slightest hint. He is surprised to discover that in certain directions he may be able to get what appears to be cooperation, but under the surface proves to be a policy of elastic retreat and advance when the pressure is diverted. He can inaugurate his ideal measures, but his foremen, or even the men, may fail to appreciate or make use of them. It is therefore wise not to be led into rapid expansion of employe-relations work, even though the men at the head of the company may be very enthusiastic about it. Soon their attention will be diverted to other things, and then the luckless employment manager may find the reaction against his work to be too great for him to stand up under alone.

The best policy appears to be to attack the problem, in a going concern, by first doing the things that appear to be demanded by the existing conditions, and then to take up from time to time things that are more directly related to production. For example, it may be found, by keeping track of the men leaving the shop, that the turnover is unnecessarily large; further, that more leave from some departments than from others, or it may be found that men leave for certain reasons rather than for others. The result of this investigation may be transmitted to the foremen, without calling names, and the statement may be made that, in order to treat every one alike, in the future it will be necessary for all hiring to be done through one central point, but that no one will be hired who is not acceptable to the foreman under whom he is to work. From this point on, it is easy to introduce physical examinations of candidates, to start follow-up work both within and without the shop, and to establish whatever system may be decided on for making the selection of workmen. The greatest difficulty begins when an attempt is made to keep in the firm's employ men who have not proved acceptable to certain foremen, either by insisting that they be given another chance or by transferring them to other departments. Foremen for generations have considered it one of their most cherished prerogatives to discharge men at will, arbitrarily, for the good of the shop, or for the venting of their own displeasure. It is a bitter blow to many of them to have this time-honored right questioned. It should only be approached after they have found that the advantage of having an adequate supply of intelligent help brought to them is so great that they cannot afford to antagonize the employment department.

In the same way, the medical department can be built up,

having purely advisory powers at first, and reporting physical defects which it finds to the employment department, with advice as to the work from which these defects should exclude the man. When the time comes when it seems best to give the medical department the right to decide whether a man is in fit physical condition to go on with work which he wants to continue and which the foreman declares it is imperative that he should, there is opportunity for a clash, which can only be avoided by letting such things alone until the time has come when the medical department has made itself so well liked and so useful that the foremen cannot afford to antagonize it. In exactly the same way, the safety engineering department has to confine itself to measures that do not in any way interfere with production until it becomes an established and accepted part of the organization.

Beginning Employment Work

The first and safest starting point for employment work is the supplying of labor to make up for the turnover which is found to exist. This is not nearly so profitable as stopping the leaks; but stopping the leaks involves apparent interference with past methods and is likely to cause trouble, as already explained. There is another advantage in not beginning with the leaks, and that is that the delay will give a good opportunity to study the causes of leaving, and this study can well be made in connection with the work of starting a flow of labor toward the shop, though action toward remedies for the leaving may not be taken for some time.

Methods of Securing a Flow of Help

Whenever business is good there is always a scarcity of help, and it is then that the greatest profit is to be made and the need of keeping the shop supplied is the greatest. Like the flow of water, labor flow can be accelerated either by drawing men in or by getting behind them and pushing them in. In general the best results are obtained from men who apply without being urged, because they feel that if they could only get a job at the shop in question they would be content to stay there the rest of their lives. The men who are pushed in, by scouts or by advertisements of high wages, are very apt to move about the country and to go very freely from one shop to another, thus increasing the cost of labor turnover rather than improving conditions.

Conditions That Attract Men

Men like to work where the wages are good, and especially where there is a chance to make some extra money by working

overtime. Men are just as much bargain hunters as women, and they like to feel that they are getting something for nothing. This is apt to be carried to an extreme, and some men are inclined to take things very easy during the day to make sure of work enough at night to get even one hour's pay for work they have not done during the day. They like a comfortable shop comfortably reached. They like safe working conditions, though that is almost always an afterthought that develops an outward flow of labor after a bad accident. Most of all, the drawing powers are money and comfort. To a smaller extent, there is the social call; that is, some men much prefer to work among friends. If one of a little coterie goes to a certain shop, the rest are likely to follow soon after. This is a little more noticeable among girls than among men, and in a small town is often an important factor.

The first concern of an employment manager who wishes to secure a reliable flow of labor toward his shop, is to make the conditions within the shop such that men will naturally desire to get jobs there. The employment manager himself is not in a position to make good working conditions. However, he is the man who hears the complaints made by men who are leaving, and it is his duty to see that a resume of the reasons for leaving reaches the management, or as high an official as he can reach. Many of the things that are found to cause men to leave do not appeal to the works manager. He very likely may have come up through the shop and may have been so accustomed to even poorer conditions that he cannot see why men should prefer to work for some employer more sensitive to shop atmosphere than he is.

Advertising for Help

Advertising may be direct or indirect. By direct advertising is meant printed newspaper advertisements, circulars, posters, or any means that directly states to whoever may see it, that the company is in need of more help. In general, direct advertising is to be made use of only as a last resort, because of the implications which it carries. It virtually tells not only prospective employes that the shop is hard pressed to secure men, but it tells the same thing to those already working for the company and also to its competitors in the field for labor. This unduly disturbs other people, sets the workmen in the shop wondering if they should not get more pay, gets competitors ready to offer larger wages, and in general should be avoided unless there is a need which no other means will meet.

Blind advertisements, or those in which the name of the advertiser does not appear, the replies to which are to be sent in care of the newspaper in which the advertisement is printed, appear to avoid all these difficulties. The greatest objection to such advertisements is that many men who would like to make a change do not dare to answer them for fear that the advertisement may come from the firm for which they are now working. This difficulty can be avoided by the person who answers an advertisement of this kind, if he encloses the answer in an outer envelope addressed to the newspaper or magazine and requests that the letter be not delivered if the advertiser is the firm which he names. This method is, however, so little understood, that blind advertisements are not so effective as they might be.

Possibly the very best advertising is that done by some companies who use a certain space in every issue of a paper, and advertise in general that their employment departments solicit applications from workmen in certain specified trades. The fact that this is a constant advertisement takes away the danger of stirring up other people, and yet the advertisement makes certain that almost every one coming into town from outside will sooner or later apply to that employment department. In a way, it is a most welcome thing to a man, who for any reason finds it necessary to move to some city, to see in the papers what at least appears to be a welcome. He may realize perfectly well that all that the employment department may do is to put his name on a waiting list; but that is something much better than a mere notice, "No Help Wanted" outside the door. In fact, such a sign is something that any well-regulated employment department should never exhibit.

Scouting

During times of great industrial activity, it is customary to try to divert the flow of labor from distant points. The theory of scouting is that by some means the employment department will discover territory in which there is unemployment, and by going there and offering transportation to their own town they will be doing a great deal of good in making a better distribution of labor. In practice, however, there is a great danger that scouting will be done where it produces the most immediate results. This is where there are the greatest number of men employed, rather than where there is the least work. Men pretty generally look up their own places to go, if there is more employment in one place than another; and the scout is very apt to find little that he can accomplish when he goes where there is no work,

because it is exactly that place that the men who have any energy and life have left.

The only really legitimate scouting is that which is done with a long look into the future and which is based on getting people to come from one undesirable locality to another more prosperous, with better opportunities for advancement, better schools for children, and better and more legitimate opportunities for enjoyment, an appeal made not on the basis of higher wages, but on better living conditions. The result of such a campaign is a slow but steady dribble of employes. If the town is up to the representations made for it, these people will write home and bring in others. Those that come through such influence are likely to stay. Those brought in by the usual scout method are very likely to use the means furnished them to come to town and to be found working for a competitor as soon as they get sufficiently acquainted with the town to know who he is. The exception to this is in the one-shop town where there is no other place to work. Shops in such towns, however, have their own problems, as it is much harder to get men to go to small places where schools are likely to be mediocre and the facilities for amusement almost sure to be poor.

In cases where men are really thrown out of employment, it is usually possible to pick up some desirable workmen, but in general the competent men have taken care of themselves before it becomes generally known that a lay-off is imminent and those left are of doubtful value.

SELECTING FROM APPLICANTS

Methods and Requirements

With a supply of help coming to the employment department, how shall we decide whom to hire and whom to turn away? The most natural thing is to go by our past experience. The great trouble with experience, however, is that as time has gone on it has eliminated certain types of people from consideration. In youth we may have had unpleasant dealings with men of a certain race, and since then we may never have hired any of that nationality. Consequently, we have had practically no experience with them, and have no right to judge them. The experience of one person who has thus shut out from consideration whole groups of people is unreliable and ought not to be tolerated.

Since every one is greatly influenced by the personal element, it is very hard to keep interviewers from making their

selections according to prejudice rather than according to common sense or science. This tendency to select by appearances has been developed into a science by several persons, who have established considerable reputation for their work. Their basis for determining qualities of men has been scientific, in that they have made studies of many thousands of men and have drawn their conclusions from these studies, impersonally, and without any intimate acquaintance with them that would be likely to bias their judgments. There are a great many employers who are by no means ready to take up this method of selection, but prefer the experience of some man in the shop in whose judgment they have faith.

Psychological Tests

For many years it has been a custom among psychologists to rate men's intelligence in terms of the normal development of children. That is, a man may be said to have only the intelligence of a ten year old child, by which is meant that he has the ability to think as fast and as correctly as a child of that age, this ability being determined by giving him a number of very simple things to do. This practice has been developed into a method of testing men, not only for general intelligence, but for the specific intelligence necessary for success in a certain trade or occupation. This method has been tried out, and gives a great deal of promise of success; but a large amount of common sense and a knowledge of the ins and outs of the trades for which the tests are given is required in order to interpret the results correctly.

Trade Tests

In a certain sense, every job is a trade test. That is, each man employed is being tested for ability in every job he does. The greater part of all hiring, even now, is done by the method of trying the man out on the job. That is, the interviewer in the employment office makes as good a selection as he can and turns those selected over to a foreman, who accepts them subject to their proving themselves to be competent.

In some trades it takes very little time to discover a man's ability. For example, the very way a blacksmith handles his tools and makes up his fire tells whether he has had experience at the trade or not; but it tells this only to men who have also worked long at the business and who know it from their own experience. The question of how good work he can do and how rapidly he can do it, can only be decided by keeping him on the

job long enough so that he forgets that he is on trial and assumes his natural pace and his natural industry or lack of it. On the other hand, there are trades where a try-out is very expensive; for example, that of a moving-picture camera man. Many thousands of feet of film are wasted on every pretentious subject, but enough is wasted at the best without trying out inexperienced camera men; so that it is not usual for a man to get a job unless his ability is well known. If he has no reputation, he must take an assistant's job and carry cameras and set up lights where he is told. After a while he is allowed to turn the crank on some unimportant scene while the camera man takes a few minutes' rest; later on, if he shows that he has grasped the principles of lighting, he may get a chance to substitute, and then, in an emergency, to "shoot" a whole play. Between the extremes just mentioned are many jobs, ability at which can be more or less easily tested.

Many specific trade tests to be given to workmen have been proposed; as, for example, to give a cabinetmaker two pieces of wood and require him to make a mortise and tenon or a dovetail joint; or, for a man who claims to be a machinist, to have a lathe handy and give him a piece of stock and tell him to cut a triple thread of some pitch not given on the gear plate, but which is possible with the equipment of gears offered; or, if the man is a draftsman, a general drawing may be given to him and he may be required to make a detail drawing of one rather difficult piece.

Such trade tests have a real and distinct value if taken in conjunction with other evidences of ability, and if they are varied sufficiently so that men will not be coached to pass them.

Conducting an Interview

As men present themselves at the employment office it is easy to pick out those to whom consideration cannot be given at that time. If a man wants a job as a plumber and the firm employs no plumbers, but depends on outside firms, he need not waste any time. Likewise all applicants for laborers' jobs can be dismissed after a sufficient number have been engaged. On general principles, however, there should be some very brief record kept, on a card or slip, as in Fig. 1, showing the man's name and address, the line of work for which he applies, and whether he wishes to be notified of openings in the future. These records are of value as showing what sort of a flow of workers there is to the plant. If the record has a line showing the last place the man worked, there is a chance to discover any tendency of

men to leave other concerns in the vicinity; or, if the man has been working in another town, it may give an indication of the conditions of the labor market there.

Employment Department

Name _____ Date _____ 192

Address _____

Age _____ Born _____

Married _____ Children _____

Employed _____ Temperate _____

Last Employment _____

_____

Worked here before _____

What Trade _____

Remarks _____

_____

_____

FIG. 1

If, after the preliminary interview, it appears worth while, the applicant may be questioned more closely and may be asked

Form 120.A 11-16 3000 APPLICATION

Date _____ For position as _____

Name _____ Age _____

In person By letter White Colored Address _____

Single Married No. of Children? Nationality _____

Total experience _____

Last Employer _____ Date _____

Length of service _____ Reason for leaving _____

Last wages received _____ per _____

Member Union? _____ Name _____ No. _____

Member Secret Society? _____ Name _____

Drink? Ever work here before? When Shop

Chew? Relatives in our employ? _____

Smoke? Could do Experience _____

How many positions during last 5 years? _____

Reasons for changing _____

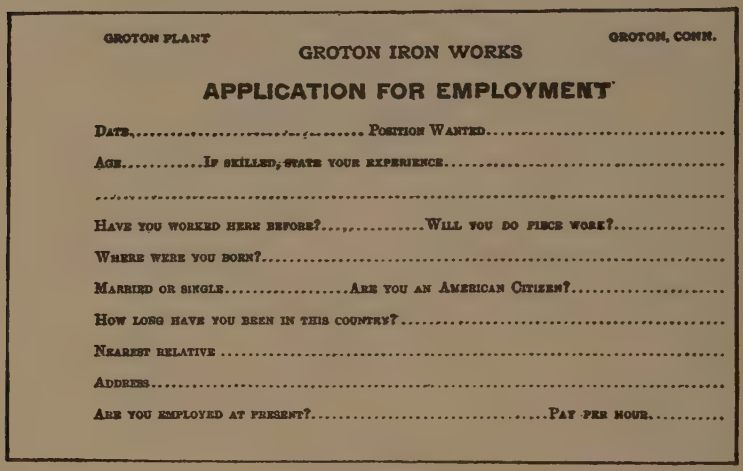
Physical data _____

Impression _____

FIG. 2

to fill out an application form or it may be filled out for him according to his answers to questions asked. Fig. 2 is an example of a quite complete application form; Fig. 3 is a very meager

one. Table I following shows the principal subjects about which information has been asked and recorded by employment departments. Of these, the necessity for some is obvious and for others, questionable. The data listed under the head Historical



GROTON PLANT — GROTON, CONN.

GROTON IRON WORKS

APPLICATION FOR EMPLOYMENT

DATE..... POSITION WANTED.....

AGE..... IF SKILLED, STATE YOUR EXPERIENCE.....

.....

HAVE YOU WORKED HERE BEFORE?..... WILL YOU DO PIECE WORK?.....

WHERE WERE YOU BORN?.....

MARRIED OR SINGLE..... ARE YOU AN AMERICAN CITIZEN?.....

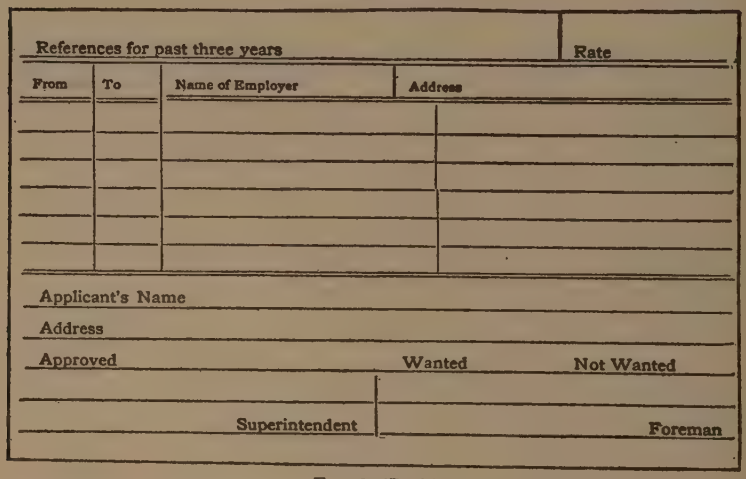
HOW LONG HAVE YOU BEEN IN THIS COUNTRY?.....

NEAREST RELATIVE .....

ADDRESS.....

ARE YOU EMPLOYED AT PRESENT?..... PAY PER HOUR.....

FIG. 3 *(Front)*



References for past three years — Rate

From	To	Name of Employer	Address

Applicant's Name

Address

Approved — Wanted — Not Wanted

Superintendent — Foreman

FIG. 3 *(Back)*

are nearly always required. Name and address, and shop number and department if the man is hired, are necessary.

Age, usually taken in terms of date of birth, is necessary in some states for all employes under 21 years of age. It may be that an age limit is set by the shop for some or all departments.

It is always desirable from a statistical point of view to know whether the average age of the employes of a shop is becoming too high. Old men are useful; but the very fact of their age necessarily implies that younger men should be in training to take their places when the inevitable time comes for them to retire from active work.

Industrial history as given by the man himself is always subject to suspicion; but the writer has had an opportunity to see many thousands of industrial histories thus given, which could be checked up with the histories which they gave to other people in distant camps, and the discrepancies were very few and easily to be accounted for by the lack of knowledge of the trades and industries on the part of the interviewers. These industrial histories are of value for two things: one is, they show the kind of shops in which the man has worked; and from the time which he worked in each a pretty shrewd guess may be made at the length of time he is likely to stay in the next shop. In connection with the industrial history, it is perfectly natural to inquire why the man left each job; and answers to this question give a very good idea of his reactions to the ways of the shops. For example, if he has found the work in one shop too hard, in the next too exacting, and in the third the management was too particular as to what time he got in in the morning, it is wise to beware of his tendency to take life easy.

Extent of education, while it may not have a bearing on the man's ability to do many different jobs, is important now that a practical interest is being taken in the Americanization of employes of foreign birth. Facts as to education also are required in many cases where it is necessary to provide school certificates for employes under 21 years of age. Of course in case of expert accountants, laboratory employes, draftsmen, engineers, etc., education is a necessary part of their qualifications.

Nationality is often rather difficult to find out, and is better determined in the manner indicated in the column headed Statistical, where the birthplace of the candidate and that of his father and his mother are requested. So many people are legally Americans, that the question as to nationality answered literally does not assist much in deciding what national proclivities and idiosyncrasies to watch out for. Whether a man is a *citizen* or not, is of interest to every shop. It is really wise to see that the alien employes are sufficiently scattered in the shops so that they will have to become Americanized.

The *married man* is preferred by nearly all employers, as

the result of long experience. This preference is partly based on the selfish knowledge that a married man will put up with a great deal more than a single man without dependents before he will quit; which may be put another way, that the married

TABLE I

Subjects About Which Questions Are Asked Applicants for Employment

Historical	Statistical	Checks
Name	Name	Name
Address	Address	Address
Shop number and department	Home address	Date of birth
Date of birth	Date of birth	Industrial history (complete)
Industrial history (3 or more jobs)	Industrial history (3 or more jobs)	Date of completion of school
Extent of education	Educational history	Desire to improve self
Nationality	Birthplace	Stability
Citizenship	of father	Sobriety
Married	of mother	Personal appearance
References	Citizenship	Courtesy
	First papers	Recreations
	Second papers	Hobbies
	Married	Avocations
	Single	Reading
	Divorced	Willingness to work
	Widower	Knowledge of work
	Children	Activity
	Number	Initiative
	Age	Loyalty
	Sex	
	Working	
	Other dependents	
	Membrships	
	Company organizations	
	Unions	
	Societies	
	Political party	
	Church	
	Army	
	Veteran	

man is much more sensible and less likely to fly off and quit in a temper than is the single man. In a way, it is not any part of the shop's business whether a man is married, single, divorced, or widowed, nor how many dependents he may have; but in any state where there are workmen's compensation laws, it is possible that at some time or other it will be advantageous to have that information. The fact that a man has been married

and is now divorced is not likely to make him either a better or poorer workman; but the fact that the divorce has left him with the necessity of hiring a housekeeper to take care of his children may have a great influence on his stability.

References are a point over which there is great room for disagreement. If former employers could be depended on to tell the truth, or to have the truth to tell regarding their workmen, there would be no doubt but that references should be required and looked up. Employes are, however, very much inclined to play safe and answer inquiries concerning former employes by stating only that they did work there on certain work and that they left of their own accord or that they were discharged. This is really about all that is safe to say; because if a workman is prevented from getting another position through any statement which has any false color there may be serious consequences to the maker of the statement.

The questions so far discussed include those almost always required. They are, as stated, really historical, but they afford considerable ground for judgment as to the caliber of the candidate.

Under the group headed Statistical, in Table I, are included other subjects for inquiry, the nature of which is such as to make them useful in summarizing the state of the force at any time. In addition to those given under Historical, there is the *home address* when it is different from the local one. This is of value in case of men who have moved to town and left their families behind until they find out how they like the new job, in the case of young men who are working at a distance from their parents, and such wanderers as have only partly taken root in the city.

For statistical purposes, it is desirable that the *educational history* be given in more detail than just enough to determine the extent of the candidate's acquirements. This is particularly desirable in the case of office employes who are offering evidence of graduation from commercial schools, as after a time these histories furnish a means for judging of the relative merits of the schools as preparatory to work.

Another subject found in the Statistical column, in addition to those already discussed, is *memberships;* this is also a matter for serious consideration. So far as memberships in things officially connected with the company are concerned, there is no doubt that the record may well be kept in the employment department. Among these memberships are included those in agricultural societies, ball clubs, canoe clubs, eating clubs, mutual benefit associations, etc.; but when the question is raised regard-

ing church and political affiliations and membership in unions, it seems futile to ask the questions, as so few men will feel themselves in any way bound to answer truthfully if at all. Of course, if a shop hires only union men, the question is eminently proper; but if the shop is a so-called open shop it creates a suspicion that it is really a shop closed against the unions if this question is asked of candidates.

Checks on the Interview

Under the heading Checks, in the third column of Table I, are listed things which become a check on the interviewer, either for his own use, if he is conscientious, or for the occasional use of his superiors. Whatever method of selection may be used, there is little doubt that final selection is usually based pretty largely on personal impressions. These personal impressions may be made at first sight, and too commonly are of that hasty kind. Before anything definite is determined, however, the interviewer ought to satisfy himself as to the whole of the applicant's past history so far as it can have any bearing on his future. There is always the possibility that, even when a man applies for a given definite job, he may be a profitable man to employ in some place of which he never heard. For this reason, the interviewer should inquire into all the applicant's past jobs, as well as the few that are recorded on the application blank.

There are men who have never had more than two or three jobs, but they are extraordinary exceptions to the rule. It is safe to say that at least 90 per cent. of all applicants have had more than four jobs; though, now that so much more employment-management work is being done, they are becoming more canny about telling of any except those that sound well. For this reason, it is also well to get the man's age, and at another part of the interview the date of his birth and at another time his age when he left school. Many firms also require his reasons for leaving school; but the replies will almost always be, "To go to work," which is only a half truth, as most boys leave school because they do not fit the system. However, knowledge of that fact may almost be assumed. When the candidate has once stated his age and the time he left school, he should account for all the intervening time.

Qualities Desired in Employes

Employers are looking for certain things in all their workmen, office force, and executives. The man who hires these people has to do the best that he can to get those having the

qualifications required. His methods may be very crude and he may fall far short of his own or his employer's ideals, but nevertheless it is right that he should keep those ideals before him.

First of all, the employer does not want lazy men. Willingness to work is therefore an essential. The next thing in order of importance is the degree of intelligence possessed by the applicant. He must know how to do the work required or be able to learn. The ability to learn is of importance, since it is beginning to be realized that, especially in the skilled-labor class, a system of training employes is needed. There has been much trouble in shops from the slowing-down influence of imported mechanics and the tendency of those who pick up trades to pick up many bad traits at the same time. On this account, many employers believe that there is sufficient reason for going to the expense of deliberately training all skilled workers for the next generation, in trade schools away from the example of bad workmanship and unsettling propaganda. So knowledge of a trade, or ability to learn easily is next in value.

Activity is something to be noted; not that all men should be chosen for their great activity, for there are many jobs in which a physically active man is out of place and on which he will stay only a short time. In shops, there are many jobs that are almost watchmen's jobs, where the workman simply stands around waiting for the machine either to do the work or go wrong. If there was not the danger that something might go wrong, he might go fishing until the stock ran out, but he is really hired for these emergencies. Fortunately, there are a great many men to whom such jobs appeal; if they are put into active jobs, they are neither happy nor successful.

Certain jobs require the constant use of initiative, imagination, and intelligence. The employment interviewer needs to be constantly on the lookout for men having these qualities, as it is usually possible to move some other man from such a job in the shop in order to take in one who really has these characteristics.

Some jobs require a good personality; others require a man who dresses neatly and who looks well in any kind of clothes. For example, a demonstrator must be able to put on overalls without losing his prestige with the general manager. Men who cannot do this may be very fine demonstrators, but the customer may have made up his mind adversely before he discovers that that particular demonstrator knows what he is talking about.

Sobriety still remains an important factor to be considered.

It is easy to ask the medical department to determine as to the man's sobriety when they are making the physical examination; but they will probably not admit their ability to judge of it any better than the employment man. The way the question in regard to sobriety is put to a man makes all the difference in the world as to the answer he will give. Most men see nothing immoral about lying as to their purely personal affairs, and no one admits that he drinks enough to affect his work.

For many positions in the office, and particularly in the case of men who are applying for jobs for which they will have to be trained, such as recent graduates from school, it is helpful to know what proclivities they have shown in their recreation. A man's avocation may very well be something which he should develop and turn to for a life work. Perhaps he has always wanted to be a photographer, but never had the courage to try it. He may only need a little encouragement. A man who is a mediocre machinist may have a hobby for photography and he may be able to do the work for which a professional is occasionally brought in; a man with a hobby for baseball or other sports may be able to organize shop sports better than a professional, for he can usually be brought to see that production is the aim of the shop as a whole.

If, at the time the man is hired, all these things are made a matter of record, as the impression which he has made on the interviewer, and if this card on which they are recorded is brought out at the time the man is a candidate for an increase in pay, or for promotion, or if he leaves, the employment manager soon gets to have a very good idea of how good a man his interviewer is, whether he is carried away by his likings for one nationality over another, and whether he lets a pretty face and attractive manners overrule his judgment when he is hiring girls. Every interviewer needs just such supervision, even if he has to supervise himself, for every one is likely to travel in ruts unless he is very careful.

Place of Interview

If it is possible to plan the place where the interview is to take place, it should be so located as to be found easily by applicants. It should be on the ground floor and only a step to the sidewalk. While it is desirable that it be centrally located so far as the shop is concerned, it is more important that it be handy to the stranger who is coming for a job. None of the other functions which the employe-relations department has to perform can overshadow this necessity. Of course there are

times when men will hunt for a job no matter whether there is an employment office or not, and no matter where it is located; but that is just the time when the employment office has the least to offer and when the shop is making the least money. It is safe to say that, whenever there is business enough for profitable operation of the plant, there is a scarcity of help of the desirable kind. In fact, most personnel offices are organized only under the pressure of need for help.

An office on the second floor is only slightly less objectionable than an office in the basement. The latter is the worst because of the psychological effect on the incoming applicant, the rest of the force, the employes of the personnel office, and the management. This is because anything which is relegated to the basement is understood, wrongly perhaps—to be out of favor with the management. Any one who is asked to apply in or to work in a basement has a feeling that the basement is a dumping place for things undesirable, no matter how necessary. If the employment department is regarded as a necessary evil, it should be abolished long enough to determine whether it is needed or not; if it is found necessary, it should be brought up to a level where it will command the services of men who will not accept a job in the cellar.

Reception of Applicants

Unless the shop is highly specialized it will require the services of a great variety of employes. However, this is a democracy and the most undesirable man is entitled to comfort while he is waiting for a reply to his request, and he is entitled to as prompt a reply as possible. The practice in the old days when a man wandered into the shop and spoke to the first man he saw and asked for the boss and got his answer in two minutes, had at least the merit of promptness and comfort. When this privilege is taken away, it is necessary to provide a suitable place for men to stay until all the different foremen who may need his services can be called up on the telephone or until the requisitions which they have sent in can be looked over. All that is required is a perfectly plain, clean room with good ventilation, and heat enough so that the ventilation can be kept up in cold weather. Smoking is not usually allowed. There should be chairs or settees, preferably folding, so they may be gotten well out of the way for cleaning. A floor of concrete, which can be washed down with a hose, is an advantage, as such a room should be cleaned regularly, otherwise the applicants will lose all self-restraint. There are only a few men who will make the first

move to defile a room, but there are a great many who will follow examples.

In some places where there are large numbers of applicants, it is customary to hand each man a numbered check as he comes in, and then to call them to the interviewer's desk in the order of their numbers. This is a fairer way than to call for all the blacksmiths, or all the laborers, or, as the writer heard once, all the Swedes. If, however, a man is required in some trade that is not usual in that shop, as, for an example, a mason in a corset shop, then it may be admissible to make inquiry of the whole crowd as to whether there is a mason present, or if any one knows a mason who can be obtained.

Where large numbers of people are handled, it is customary to have a very brief preliminary interview and to admit to an inner waiting room such persons as are to more carefully talked to for present or future employment. This inner waiting room can be subdivided into as many parts as there are interviewers; and by sending all applicants of one class to one interviewer and those of another class to another, and so on, the applicants can be separated so that those of refinement will be much better situated. There is also the additional advantage that the interviewers can be selected for their acquaintance with different kinds of work and thus become experts in the selection of men for different parts of the shop.

Interview Rooms

The practice of having separate rooms for each interviewer with a waiting room for each, is growing in favor over the cheaper plan of having all interviewers at desks in the same room. Much of what is said between applicant and interviewer is confidential and should not be made public property. This applies both to personal history and to the offer of employment made to the successful candidate. Unless the company makes a definite practice of paying a certain beginning rate to every one taken on for a given job, it is advantageous to have the rate actually paid in individual cases kept confidential. If the next man in line overhears an offer being made that he considers too low, he may not stay for an interview at all; while if he hears one that is higher than he intended to ask, he may demand the same, without regard to his lack of experience as compared with the other man.

If the small room is used, it need only be separated from the others by low partitions, as it is the sense of privacy only that is needed. The lighting should be good, but not glaring,

and should fall full on the applicant. The first response to questions is usually through the facial muscles. Intelligence appears often through the eyes, so that much more can be learned about a man by looking at him, than by merely taking down his answers. The equipment is most simple. A table on which to make out the necessary application blank, and two chairs, are sufficient, unless occasionally another chair is needed for an interpreter. It is best, however, not to encourage men in bringing in their friends to talk for them, as this does not help the interviewer to come to any logical conclusion.

Functions of the Interviewer

There is a variety of practice as to the functions of the interviewer. In some cases the man is really hired before he meets this official, in which case the interviewer bocomes merely a clerk to secure certain information for the records. In other instances the interviewer makes recommendations to some one individual that a certain man be hired, and that person makes the final decision after looking over the application blank. In this case, the interviewer soon learns how to play up the application to secure the applicant a job and how to write it so that he will be turned down. In most places, however, the interviewer is the man who settles the whole matter. This seems better, if for no other reason than that the applicant does not find himself passed from hand to hand, but can deal with one man all the way through.

PHYSICAL EXAMINATIONS

Purpose of Examinations

The number of shops at which physical examinations of all applicants for work are required is increasing. The true purpose of such examinations is to enable the employment department to place men where they will be most effective and where their working lives will be lengthened rather than shortened by the work. These examinations have accomplished another thing that is of at least equal value; and that is, they have brought to notice the harmful things in the shops and processes of the company and have often secured their removal or their improvement. The fact that many of the men who are high up in the industries of today worked in shops themselves under any but good conditions, tends to blind them to the shortcomings of their own management when the humanitarian side of it is presented to them. The word of a physician, however, makes a

much greater impression on such men than does that of any layman.

The physical examination should be sufficiently thorough to discover any trouble that might cut down production or injure the man if he should keep steadily at the proposed work for a considerable period. A very concise but full form for recording a medical examination is shown in Fig. 4.

It is very desirable that the physical examinations be conducted close by the interviewers' rooms, as the doctor and the interviewer should very often wish to confer informally, rather than by written report. The doctor should, however, certify on the record that the candidate may safely work at the job offered him unless the man is in so good condition that he can certify him for any job.

From the doctor's point of view it is desirable that the examination room be close to the infirmary and hospital where accident and illness cases are taken care of. If it is not, there will be delays in getting examinations made, and delays in getting the other work attended to. Similar conditions apply to the location of both the hospital and the employment office, though the hospital can be on a floor higher up if there is an elevator handy for patients who cannot walk to the hospital. The hospital has still more need of light and air than has the employment department, so an arrangement by which the hospital is over the employment room works out well.

Common Disabilities

Many works managers will say that there is no need for these physical examinations, on the ground that in their long experience they have never found it necessary, and that they can tell whether a man is sick or not just as well as the doctor. For that reason, it may be desirable to remind such managers of some of the things that may have a great influence on a man's work, which are not usually noticed by a layman. For example, a man may have had at some time a blow on the head, which has left no visible mark, and yet it may have left him in such condition that he cannot, or ought not, go on a staging or any high place. Years ago such men were called cowards and were dared to go up, until they went and fell and were badly hurt. Examination would show that these men are not malingering, and they may be efficient in positions for which their disability does not unfit them.

Some of the common disabilities, which are more or less noticeable, are as follows:

NO._____

DATE_____

THOMAS A. EDISON INDUSTRIES

PHYSICAL EXAMINATION RECORD
OF

_____

SEX { MALE / FEMALE

SINGLE
MARRIED
WIDOW-ER

HEIGHT_____FT._____IN. WEIGHT_____LBS. UNDER / OVER WEIGHT

EYES	O. D.	O. S.	WITH GLASSES O. D.	WITH GLASSES O. S.
	20 /	20 /	20 /	20 /

HEART:_____LUNGS:_____

TEETH: NUMBER MISSING X / NUMBER DECAYED O

	RIGHT								LEFT							
UPPER—8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
LOWER—8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

EXTENSIVE DENTISTRY_____ULCERATIONS_____TONSILS_____

EARS— R._____FT._____IN._____ L._____FT._____IN._____

GENERAL APPEARANCE:_____

ROBUST PALLID ANAEMIC WEAK STRONG

SPECIAL COMMENT:

I NOW HAVE _____ ENLARGED INGUINAL RINGS AND THEREFORE HAVE A PREDISPOSITION TO HERNIA. IN CASE AN INGUINAL HERNIA—EITHER SINGLE OR DOUBLE—SHOULD DEVELOP DURING THE TERM OF MY EMPLOYMENT I WILL NOT HOLD THE_____ LIABLE FOR ANY COMPENSATION FOR EITHER TEMPORARY OR PERMANENT DISABILITY UNDER THE NEW JERSEY WORKMEN'S COMPENSATION ACT OR AMENDMENTS THERETO.

SIGNATURE _____

EXAMINER_____

APPROVED BY_____ M.D.

FIG. 4 *(Front)*

EYES: COLOR BLIND EYE DISEASES

SUBJECT TO HEADACHE:

LUNGS: ABNORMAL PHYSICAL SIGNS:

DIAGNOSIS:

HEART: BLOOD PRESSURE (See Note)

APPENDICITIS:

GENERAL APPEARANCE: MALNUTRITION DEFORMITIES

GLANDS PARASITES

HABITS AS TO ALCOHOL: TOBACCO:

HABITS AS TO OTHER FORMS OF STIMULISM:

SKIN AND MUCOUS MEMBRANE:

LOSS OF HAIR GENERAL OR LOCAL:

NOSE: OBSTRUCTED BREATHING CAUSED BY:

DEFORMITIES:

NERVOUS SYSTEM: LOCAL PARALYSIS EPILEPSY

NEURALGIA ST. VITUS DANCE

DISEASE OF NERVOUS SYSTEM:

SUBJECT TO HEADACHES: SLEEP: WELL POORLY

EXTREMITIES: DEFORMITIES VARICOSE VEINS

HISTORY OF DISLOCATION:

FLAT FEET STIFF JOINTS

EVIDENCE OF ACTIVE VENEREAL DISEASE:

SPECIAL COMMENT:

FIG. 4 *(Back)*

Many men have defective eyesight, and do not know it. Men have been totally blind in one eye and never happened to discover it. There are diseases of the retina and the optic nerve that are not correctible by glasses. The layman cannot discover these things, but the examining physician will send the man to an oculist who can definitely determine whether anything can be done or whether the man will have to be assigned to some work requiring limited capacity.

Men sometimes have trouble from two little pockets in the head just above and each side of the nose, causing intense headache for which none of the ordinary remedies produce relief. The pain is so intense that the victim cannot do even the most ordinary work efficiently. A comparatively simple operation will cure or greatly relieve the situation. Most nose troubles are easily relieved, but if they continue to exist they bar a man from comfortably working where there is dust.

Deafness is no bar to many trades, in fact a man may do all the more work because of the lack of distraction. However, no deaf man should be employed where there are dangers of which he could not hear a warning; as, for example, working under a traveling crane or on a staging around a building where some one might knock him off by swinging the end of a stick of timber around, unless he heard the warning yell. Similar dangerous conditions for a deaf man exist in a dye house or tannery around vats containing hot liquid, in a steel mill around the rolls, and so on.

Likewise, a man with a stiff neck, so that he cannot look upwards, should not work under a traveling crane, and he cannot do plastering or any of the jobs that require reaching over his head and seeing what he is doing there.

The most common accidents are those to the fingers. Fortunately the considerable number of fingers with which we are endowed makes it possible to do quite a number of jobs even with two or three missing. The forefinger on the right hand, if the man is right handed, and the thumbs on either hand, are the most necessary for most skilled work.

A man may have flat feet which cause him such pain that he cannot do work to advantage. He may know how to do it, and he may take the job in all good faith that he can and will put up with the discomfort; but if his feet are very flat, he will almost surely give it up in a short time and simply swell the labor turnover, unless he can sit and get his weight off his feet a considerable part of the time. The medical department will prescribe proper plates to be worn in the shoes, if the case is

not too far advanced; but even these and constant strapping do not give relief in bad cases.

Injuries to the toes are apt to be lightly thought of by the layman, who looks on toes as mere dwarfed fingers and of no use; but a man who has lost his large toe has lost his support in walking, and is uncertain in his movements. He should not be employed where his ability to balance is of importance.

Hernias are dangerous unless cured by operation, which is usually simple and safe; however, many men prefer to wear a truss, which is unsafe, because the truss, if worn in such a way as to be of any value, is uncomfortable, so they are apt to loosen it, especially in hot weather. Such men should not be employed where there is lifting of much weight even in emergencies. They are safer where lifting is constantly required than where it is necessary only in emergency; for where lifting is a part of the job they realize the need of self-protection, but under other conditions they get careless.

Old appendicitis operations apparently do not bar a man if the wound of operation is well healed, and if there are no adhesions of the intestines. If there are, the man may look just as well as he ever did and yet not be able to do work requiring much motion of that part of the body, since motion causes pain which can be borne only for a time.

Stomachaches are usually lightly passed over, but a man with a history of repeated attacks should be looked over carefully for hidden ulcers or cancers. He may need work, but he cannot continue at it long; and he should put himself in a position to be cured, if possible, rather than have his trouble aggravated by taking up active work.

The greatest single enemy which the layman cannot detect until late is tuberculosis. This is especially dangerous, because it is communicable and one man may injure many others if he does not know that he has this malady or if he does not follow the rules closely. The only right place for sufferers who are in the active stages of the disease is in a sanatorium or at home under competent advice. After their trouble is arrested, they should not do any work that requires strenuous motion of the arms and upper part of the body, because it may break down the wall which has been built up in the lungs to separate the diseased portion from the well. A man who has been through the long struggle to keep the disease in bounds should not be subject to the orders of some foreman ignorant of the effects and who may insist that a man take hold and help for a few minutes at some task that will cause him months if not years

of effort to counterbalance. It really seems that in a large shop some special employment should be assigned to employes in whom tuberculosis has been arrested, and this should be under the care of some foreman who knows thoroughly just what such persons should or should not do, preferably a past victim of the disease himself. In many shops the idea of having either past or present tubercular cases at work is abhorred; and yet, without a thorough medical examination, both forms of cases may be present without proper precautions for either. Barring men from employment because of their past sickness is neither economic nor humane. Such men need work, not only to support themselves but to keep them well mentally as well as physically. They should not be shunned; but while in the active stages they should observe the usual sanatorium regulations just as much at home as elsewhere. The old idea that those recovering from tuberculosis must have a light outdoor job is no longer in good favor; for there are few jobs of that kind, and such persons need to be sheltered from the inclemencies of the weather. They need fresh air and plenty of it, but they need no more than the rest of us do for our own good health.

Bronchitis is a much more common ailment than it was before the World War. Nearly every one had a susceptibility for it, but it took the gassing which so many soldiers experienced to make it a real disability. These men were to all appearances cured before they were discharged, but they were cured under good conditions of ventilation. The result of being closely housed is that they soon become very susceptible to colds, and these colds develop into really bad cases of bronchitis, which, in turn, lower the vitality of so many that the tubercular germs become active. Gas probably did not convey tuberculosis but merely acted to make the patient less resistant. For this reason the medical department of every shop owes it to the community to keep close watch of every soldier who was abroad, and those that were in the experimental work in this country and see that they work under conditions conducive to good health, for that is the one thing necessary to oppose the germ of tuberculosis.

Heart trouble is sometimes visible to a layman, but it is more often that the symptoms which he takes for heart disease arise from lung or stomach troubles. However, there are a great many men with heart disease who will outlive others with perfectly sound hearts, and earn a living nevertheless. It is very necessary that these cases be seen at regular intervals by

a competent physician, and that the regulations as to the exercise and work which the men may take, be rigorously followed. There is no reason for debarring a great many of these men from useful work, and their cure is much more rapid if they are given the substantial encouragement of a job.

Teeth are of course observable by a layman, but he is not apt to look on a few decayed teeth as any hindrance to a man's efficiency in the shop. Yet a man with bad teeth needs more time to masticate his food, and if they are accompanied with abscesses at the roots, he is likely to have rheumatism. If he does not take the extra time to chew his food thoroughly, a larger burden is thrown on his intestines than they should have and he is liable to all sorts of trouble, which keeps him on the sick list when he might otherwise be earning his living.

One of the favorite troubles that workmen have, especially since the advent of workmen's compensation laws, is a sacro-iliac strain, otherwise a backache. Whether or not they have this, is not easily determined by the layman and not much more certainly by the doctor. If a man asserts that he has such a strain, about all that can be done is to believe him, unless he forgets himself and bends over suddenly without signs of pain. If he really has a serious limitation of motion in his back he is quite likely to have rheumatism. There is also a chance that some fall, regarded as insignificant at the time, may have cracked some one of the little points on the vertebræ to which the muscles are attached. That is, it is not safe to treat any case of alleged backache as malingering, without looking into all the possible ways in which the patient may have been injured.

The Industrial Physician

There have not been very many positions for industrial surgeons which are attractive from the point of view of a medical man. A doctor always has hopes of a large and profitable practice. As a young man without experience, he does not see anything in industrial work to lead him to this kind of practice, since it brings him in contact mostly with the kind of patients to whom his minimum charge would be a burden. As he grows older, he either gets his hope and has a large and profitable practice, which he could not possibly afford to give up for any industrial job, or else he does not get it, and all count him a failure. He is then willing to take an industrial job, but there are no openings for him.

The result is that the few men who do go into industrial

Courtesy of Ford Motor Company

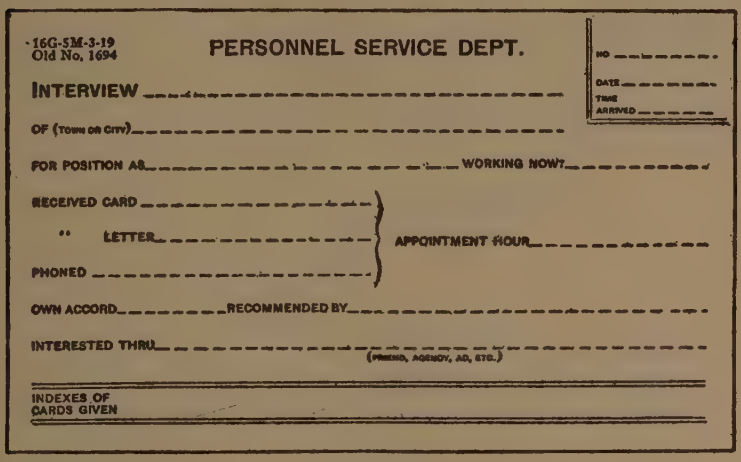
PERSONNEL IN BUSINESS

First aid department and hospital of a modern plant.

surgery are those who are imbued with the missionary spirit and who are willing to make the sacrifice for the sake of the good they can do. When more shops see the need and profit in this work, there will undoubtedly come a recognition of the value of the medical man's services, and doctors will be paid for keeping the shop population well instead of on the basis of curing the sick. That is, preventive medicine which is a misnomer because it uses almost no medicine, will take the place of pills for ailments. If a good medical department can reduce the amount of absence from the shop 2 per cent., and the pay roll is $5,000,000 a year, then $100,000 is added to the working pay roll. If the firm makes a 10 per cent. profit on the work of its employes, then the department has saved $10,000, an amount that would be attractive to many excellent surgeons.

Relations of Employment Department to Those Employed

Custom varies in different places as to whether the employment manager shall hire the workmen or whether the foreman shall do it. In the latter case, the applicant might be sent to the foreman with a slip such as that shown in Fig. 5, which would


16G-5M-3-19
Old No. 1694

PERSONNEL SERVICE DEPT.

NO _____

DATE _____

TIME ARRIVED _____

INTERVIEW _____

OF (TOWN OR CITY) _____

FOR POSITION AS _____ WORKING NOW? _____

RECEIVED CARD _____

" LETTER _____ APPOINTMENT HOUR _____

PHONED _____

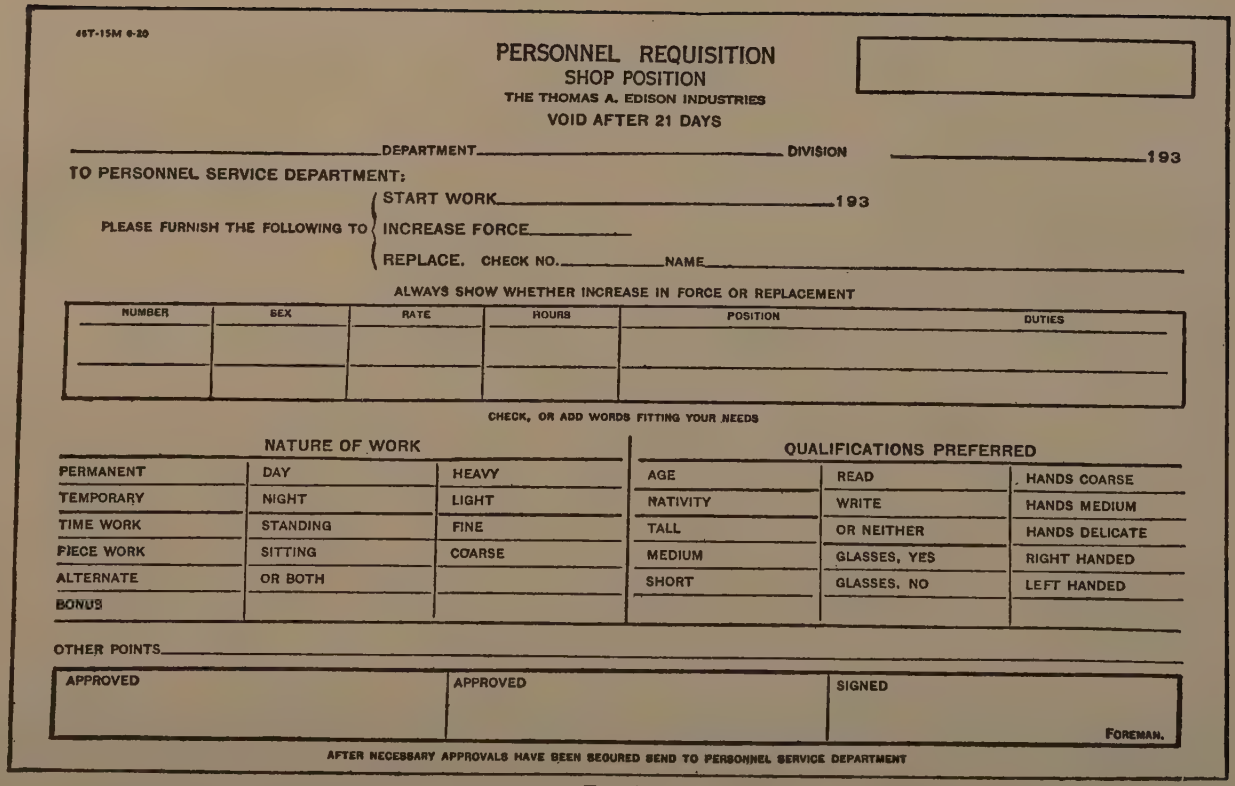
OWN ACCORD _____ RECOMMENDED BY _____

INTERESTED THRU _____
(FRIEND, AGENCY, AD, ETC.)

INDEXES OF CARDS GIVEN

Fig. 5

serve as a letter of introduction. One object of employment work is to take the hit-or-miss method of hiring out of the hands of the foremen and standardize it. The question arises, shall the foreman be consulted or shall the employment department merely send him men according to his requisitions and tell him to do the best he can with them? This is not a simple ques-



46T-15M 6-20

PERSONNEL REQUISITION

SHOP POSITION

THE THOMAS A. EDISON INDUSTRIES

VOID AFTER 21 DAYS

_____ DEPARTMENT _____ DIVISION _____ 193

TO PERSONNEL SERVICE DEPARTMENT:

PLEASE FURNISH THE FOLLOWING TO { START WORK _____ 193 / INCREASE FORCE _____ / REPLACE. CHECK NO. _____ NAME _____

ALWAYS SHOW WHETHER INCREASE IN FORCE OR REPLACEMENT

NUMBER	SEX	RATE	HOURS	POSITION	DUTIES

CHECK, OR ADD WORDS FITTING YOUR NEEDS

NATURE OF WORK			QUALIFICATIONS PREFERRED		
PERMANENT	DAY	HEAVY	AGE	READ	HANDS COARSE
TEMPORARY	NIGHT	LIGHT	NATIVITY	WRITE	HANDS MEDIUM
TIME WORK	STANDING	FINE	TALL	OR NEITHER	HANDS DELICATE
PIECE WORK	SITTING	COARSE	MEDIUM	GLASSES, YES	RIGHT HANDED
ALTERNATE	OR BOTH		SHORT	GLASSES, NO	LEFT HANDED
BONUS					

OTHER POINTS _____

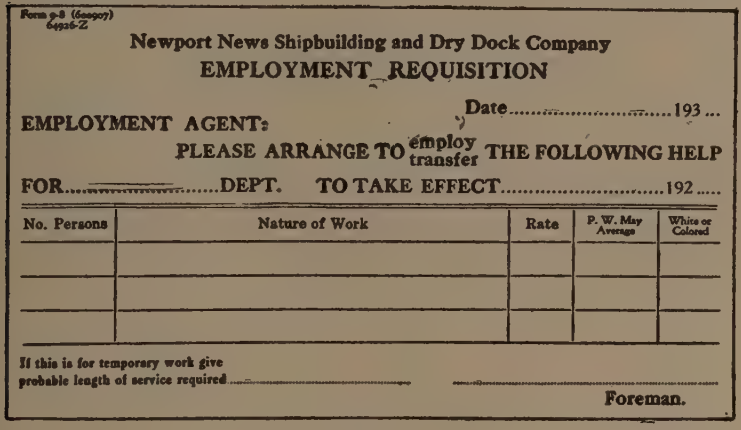
APPROVED	APPROVED	SIGNED
		FOREMAN.

AFTER NECESSARY APPROVALS HAVE BEEN SECURED SEND TO PERSONNEL SERVICE DEPARTMENT

FIG. 6

tion by any means. The average man looks on the person who gets him or gives him a job as a friend. If he thinks the foreman does the hiring, the foreman is his friend, and the man will try to please him. If he thinks the employment department selected him, he may have a feeling of contempt for the foreman who subserviently took him on. The best way is to have the employe understand that both the employment department and the foreman had an equal share in hiring him and he should not be allowed to forget that both parties know that he is there.

This can be accomplished without friction, if the employment department offers its men as candidates only, subject to the approval of the foreman. In that case, the employe realizes that he would not have reached the foreman except through the



Form p-8 (6m9o7)
64926-Z

Newport News Shipbuilding and Dry Dock Company

EMPLOYMENT REQUISITION

EMPLOYMENT AGENT: Date.....193...

PLEASE ARRANGE TO employ transfer THE FOLLOWING HELP

FOR.....DEPT. TO TAKE EFFECT.....192.....

No. Persons	Nature of Work	Rate	P. W. May Average	White or Colored

If this is for temporary work give probable length of service required.....

Foreman.

FIG. 7

approval of the employment department, and he also realizes that the approval of the foreman makes the latter an equal factor in the matter. There is really no loss in prerogative for either; and if it is necessary for both to agree on the men, there is a better chance of a good selection. The one exception to this is in the case of men who apply at the instance of the foreman and are not approved by the employment department. This is, however, as it should be; for a foreman should never be allowed to hire his own personal friends without some check. There is all too much chance that the employment department will wink at these selections and let the man in without much regard to his merits in order to make it easier to get other and corresponding favors.

Where help is hired by the employment department, the

foremen usually make requisitions on that department by use of forms like those shown in Figs. 6 and 7.

Identification of Workmen

When a man is once hired it is necessary to get him on the pay roll, and to give him some means of identification so that the paymaster may give him the proper envelope. This is not necessarily a function of the employment department, but that department is often found to be the easiest place through which to make this identification. The means of accomplishing this identification range from the commonly used brass check to the elaborate schemes of photographs and thumb prints used during war as a means of identifying the employe and of guarding against spies.

The brass check is effective and simple. Possession of the check gives the right to the week's pay. If the man loses the check, he is supposed to report the loss and get a new number and another check, then if the original check is presented there is prima-facie evidence of an attempt to defraud. The only danger is that the man who loses the check may not report it until after some other man has presented it and obtained the pay envelope, or the chance that some man with an unpronounceable name may decide to leave the shop and hand over his check to some relative or friend, and the shop thus may change help without being aware of it.

Cardboard passes, signed by the works manager or some high official, are usually the next step. They appear to offer only the advantage that they are not so easily imitated by men who wish to obtain access to the work. After the official has signed the first 500 by hand, however, he is likely to get a rubber stamp for the rest, and from then on he might as well not issue them at all. Photographs are the next resort, but any one can take a photograph. The fact that a man has his photograph on a pass signifies nothing; the question is, is it the photograph of the man it purports to be? One firm, at least, has handled this matter rather cleverly by having a small seal made with which each official photograph is impressed. This seal is not easily duplicated. By photographing the man's shop number with him on the same plate and then imprinting the seal partly over the number, the whole combination is pretty closely tied together. The photograph, however, should be large enough so that the paymaster or the gateman, or whoever is to see it, can not help looking at it. This cuts out the postage-stamp size, or the motion-picture-film size. Nothing much less

than 2 inches by 3 inches will be a means of actual identification. One firm used photographs of this size showing both a full front view and a profile. This seems like a very elaborate precaution; but they were engaged in very important war work

Form 305	EMPLOYMENT RECORD	
No.	Engaged as	Date
Name		Rate
Address		Telephone No.
Single	Married	No. of Children Age
Total Experience		Nationality
Last Employer		Address
Date	Clock No.	Reason for Leaving
Length of service		Last Wages Received
Member of Union	Name	No.
Drink	Chew	Smoke
Ever Work here before	When	Shop
Relatives in our employ		
Physical data		Impression
Years Apprenticeship Served		
Under Whom		
Home Address		
Member Society	Name	OVER

FIG. 8 *(Front)*

Rate Changed From	to	date
" "	"	"
" "	"	"
" "	"	"
" "	"	"
" "	"	"
Transferred to		Dept.—Date
"		"
"		"
"		"
Quit	Reason	Date
Laid-off	Reason	Date
Discharged	Reason	Date
Remarks:		

FIG. 8 *(Back)*

and the extra feeling of safety was undoubtedly well worth all it cost.

If photographs are used, the proper time to take them is just after the man has been accepted by the employment department and approved by the medical department, and before he is taken to the shop. In the few cases in which he is rejected by

DOWNEY SHIPBUILDING CORPORATION
STATEN ISLAND

Name_____ Date of Birth_____ Place of Birth_____
(Last Name) (First Name) (Middle Name)

Address_____ Company Number (_____)

If not native born, first papers? (_____) Second? (_____) Date came to this Country_____

Married (_____) Unmarried (_____) Number of Dependents (_____)

Schooling: Name and address school attended	Years	Graduated?	Specialized in
Grammar			
High			
College or Technical			
Trade or Business			

EXPERIENCE (last three jobs):

For what firm (give address)	Dates From	Dates To	Exact duties	Reasons for leaving

What trade do you desire to learn?_____

Describe any experience you have had in furnishing entertainment_____

FIG. 9 *(Front)*

In the columns to the right draw **TWO LINES** under those occupations at which you are an expert; draw **ONE LINE** under those at which you have worked. After each underlined occupation write also the number of years (i.e. 1, 8, 5,) of experience you have had in that occupation.

If you have worked regularly at any other occupation not mentioned in these columns write it here:

_____

_____

Blacksmith	Gas Cutter and Welder	Shearer
Brass Foundryman	Steel Worker	Rolls
Boiler Maker	Bolter-Up	Joiner
Carpenter	Fitter	Loftsman
Caulker	Riveter	Laborer
Coppersmith	Driller	Machinist
Draftsman	Holder-On	Class
Dockman	Heater Boy	Painter
Electrician	Passer	Pattern Maker
Engineer	Puncher	Pipefitter
Electric Welder	Countersinker	Rigger
Foreman	Planer	Storekeeper

EMPLOYMENT

Date Entered	Department	Position	Daily Wages	Date Leaving	Reasons

RATING	Very Good	Good	Average	Poor	Very Poor	Remarks
Appearance and manners	( )	( )	( )	( )	( )	
General intelligence	( )	( )	( )	( )	( )	
Reliability	( )	( )	( )	( )	( )	
Ability to supervise men	( )	( )	( )	( )	( )	

Best fitted for _____

Experienced ( ) Learner ( ) Laborer ( ) _____

TERMINATION OF SERVICES: Date of Leaving_____ Reasons_____

Wages ( ) Hours ( ) Heavy, wet, dusty, etc. ( ) Housing ( ) Change of employment ( ) To what ( )

Insubordination ( ) Incompetence ( ) Intoxication ( ) Irregularity ( )

FIG. 9 *(Back)*

Surname	Given Name	Department Symbol	Department Check No.	Date Rated	Rate
ADDRESS					
BEGAN WORK	Hour / Date / New Or Old.....Dept.				
Age	Married / Single / Children Under Age / Nationality				
Trade	Position				
Q D N LO	Date Terminated / Date Last Worked / Memo.				
Transferred TO DEPT.....	Date				
REMARKS					

RECORD CARD—*MERCHANT SHIPBUILDING CORPORATION*

NOTE—When Employee is Transferred This Card Should be Forwarded With Duplicate Transfer (Form 252) to Next Receiving Dept. When Employee is Terminated This Card Should be Forwarded with Duplicate Termination Notice (Form 254) to Employment Office.

FIG. 10

the foreman, his photograph can be crossed from the list and the number assigned him be transferred to some other more fortunate man.

Value and Use of Records

It is very desirable to have ready access to all the information that the shop has regarding every past and present employe. In every case of promotion, or of increase in pay, or lay-off, or accident, or even illness, there is need of immediate use of records. Between whiles, there is the need of keeping statistics, so as to be sure to maintain a proper balance of the various races among the help, and to be able to furnish the other vital statistics which are of constant use to the management.

The forms of records to be used will vary according to circumstances. Fig. 8 shows a small but comprehensive record card. Fig. 9 shows a form record that requires a minimum of writing. Part of this record is in the form of an application and much of the data can be indicated by check marks or by a single word. A record for use after a man is on the job is shown in Fig. 10. In Fig. 11 is a form for a yearly attendance record, and Fig. 12 shows the form for a severance of service card that is sent to the employment department when an employe is discharged or gives notice that he is to leave. This card gives the employment department a chance to review the case. A notice from the personnel department notifying the pay-roll department of the termination of the employe's connection is shown in Fig. 13. Fig. 14 is the form of a report that is an excellent precaution, as by it both the man and the foreman have their attention called to the necessity for instruction in safety.

Almost every employment manager starts his career by trying to develop a single card that will carry all the data required for each employe. He never succeeds, but sooner or later he either gives up the idea altogether or else he devotes an envelope, or folder, to each case.

The question then arises as to the value of keeping records. Many managers feel that, so far as the men actually on the pay roll are concerned, it is easier to go to them and get any desired information. When the question of increase in pay comes up, the pay roll itself may be consulted. If it is a matter concerning accident insurance or insurance of employes, ask the man or the insurance company. The advisability of keeping records and what shall be recorded are questions of profit and loss only. If records are never consulted and there is no legitimate reason

NUMBER ADDRESS

SHOP YEAR

DATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
January																															
February																															
March																															
April																															
May																															
June																															
July																															
August																															
September																															
October																															
November																															
December																															

NUMBER OF WORKING-DAYS_____ ATTENDANCE (PER CENT)_____

NUMBER OF ABSENT-DAYS_____

KEY:-- Symbols marked in the left half of a space indicate A. M.; in the right half--P. M.
Days-- BLACK INK. Nights-- RED INK. Symbols signify as follows:

ABSENT		TARDY..AL..	EARLY EXIT	
	Unknown...AN...		Unknown ...EN...	
	Excused....AX...		Excused ....EX...	H—HIRED
	Sickness....AS...		Sickness ....ES...	T—TRANSFERRED
	No work...AK...		No work....EK...	F—FINISHED
	Disciplined..AD...		Disciplined..ED...	

FIG. 11

Norton Companies Worcester, Mass.

REPORT ON EMPLOYE

Date_____ 193

Name_____ No. _____ Assigned to Dept._____ 193

Department_____ Will leave Dept._____ 193

Cause of leaving _____

_____ Signed _____ Dept. Head

Disposition of Case _____

_____ Signed _____ Employment

Amount Due

$_____ Week ending _____ 193

$_____ Week ending _____ 193

Approved { Employment Mgr. _____ For Payment _____

Noted { File _____ Hospital _____ Paymaster _____ Cost _____

360-9-17-4M.

Fig. 12

why they should be consulted, they had best be left unkept. If the only thing taken into account when wages are readjusted is length of service and the last wage received, there is no need

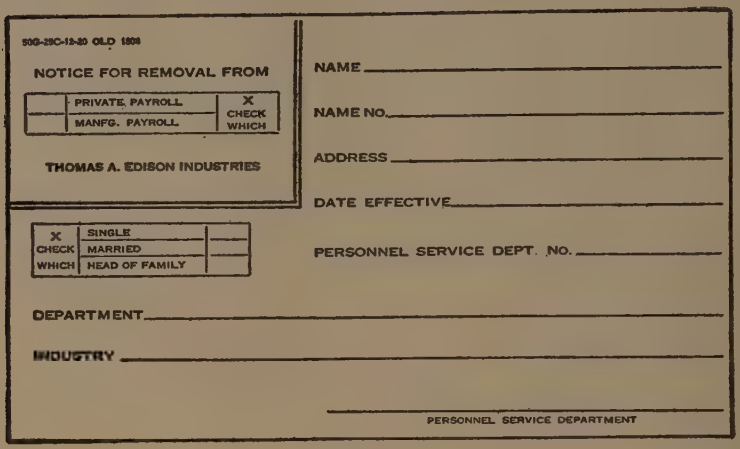


FIG. 13

of consulting records in the employment office for such data. If all candidates for better jobs are drawn from outside the organization and no one inside is promoted except by favor, the records of the employment department have no value so far as

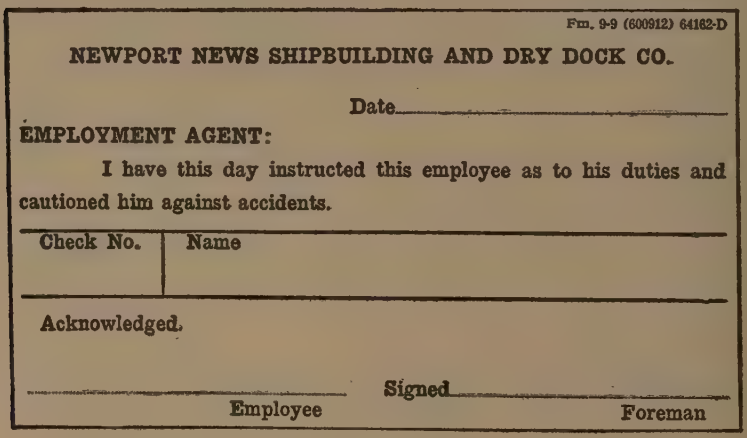


FIG. 14

promotion is concerned. If, on the other hand, men are treated in all respects on their records, then the records must be kept in such form that they can be easily consulted. If the records of

only one man in a hundred are consulted, it is cheaper to take similar records of all the men than it is to get that record in an emergency by going to the man or to other sources of informaton.

If, as will be explained later, follow-up work is done either in the shop or outside, there must be some report so that the proper action will be taken and so that the amount of follow-up work will be known and its value estimated. Once the record is taken, it costs almost nothing to place it in the man's folder or envelope.

If records are kept at all, there are obvious advantages, from the standpoint of efficiency, in having all the records of each man in one place. Of course there will be a little duplication of work with the pay-roll department, because the latter has the original record of the man's rate of pay. It is, however, desirable that the employment department keep this record, as that department should be a party to the agreement. It is also necessary that the employment department should know what the employe's pay has been when recommendations for increases are pending.

The safety engineering department will undoubtedly have need for holding the whole record, folder or envelope, of such men as are under its care through having met with injuries for which they are entitled to compensation, and the medical department may wish to consult the records from to time, but it is seldom that two departments will need one man's folder at the same time. There will be many times when some matter for which the records are required comes to the attention of the general manager; but that is likely to be in the case of some old and especially worthy employe who is in need of special and peculiar attention, or in case a man has trouble or misunderstanding and the management wishes to know whether to assist him or not. Experience indicates that, when thoroughly kept, these folders are consulted often enough to justify keeping them. However, unless they are kept well they had best not be kept at all. There is likely to be more difficulty in getting well-kept records from the hospital than from all other departments together, as there seems to be something in the make-up of successful medical men which abhors all records; part of this appears to be a reluctance to make written statements about things concerning which they are in doubt, and the rest the natural disregard for order which seems to possess most purely professional persons.

Conditions the Employment Department Must Meet

After the employe is once on the pay roll, the test of the employment department's selection begins. It therefore behooves that department to make sure, so far as possible that the men it has selected get a fair chance to make good.

When an organization has, through its chosen department, bought labor in large quantities—in even a moderate-size concern the amount is over a million dollars a year—it seems as though it would make every effort toward the best possible use of that supply. This would only be good cooperation. Any newly organized employment department, however, meets jealousies which, foolish as they are, must be overcome before the department establishes its place in the organization. There are jealousies on the part of the foremen, who enjoy taking an hour off from work and going to some part of the plant to look over the applicants for a job, and who find that they can stay right on the job of supervising their departments while the supply is being gone over and brought to them for inspection.

Also, there are the employment agencies, that have made money out of the shop by sending men to work, then offering them other jobs and getting them new jobs all over again. Their methods are directly the opposite to those of the plant employment department, as the greater the turnover of labor the more money the agencies make. If they can shift a man from one shop to another every month, they make as much money as if they shifted twelve men once a year. These agencies will work indirectly to discredit the new department, even in some cases to the extent of deliberately sending to it the most impossible candidates for jobs. The employment department may be able to make use of some men from this source, but only after giving them fully as careful scrutiny as is given to any others.

Some opposition, also, may develop among the employes themselves, especially the older men who are accustomed to get and hold jobs through personal favor rather than merit.

Follow-Up in the Shop

It is for everybody's interest, not only that the men selected and approved do well, but that the management know that they do well. If the company is on a piece-work basis, the employe's good work shows on the pay roll, but it is an exceptional shop where half the workmen are on piece work or any form of compensation that requires the keeping of accounts with each

employe in such form as to indicate his value to the company. The rest of the men are usually on day or hour rates, which are likely to have little relation to what they earn for the company. For this reason, it seems that the record of piece-work and premium, or bonus, earnings should be looked over by the employment manager, if for no other reason than that he may know how well the employes of his selection are making out.

Then there should be a general looking over of the shop to find out if any employes are dissatisfied, before their dissatisfaction becomes acute. It is very natural that men hired through the employment department should bring their grievances to the attention of the men in or from that department more readily than they will to the foreman. They have had experiences with foremen whose only answer to a complaint was to discharge the complainer, but they do not suspect the employment department of either the disposition or the power to discharge. A great deal of follow-up work is, therefore, automatic, if the representatives of the department only circulate around the shop; and that they should surely do, if for no other purpose than to keep up to the times as to changes in methods and places where work is done, and to know at first hand what the work is for which they are selecting men, and the conditions under which the work is done.

Shop Changes

A very little experience of the kind just mentioned will show, in almost any shop, that there are things that could be changed to make the work easier or more attractive. These things will vary from little idiosyncrasies of foremen to really vital things affecting the health of the employes. It has been the habit of many shop managers to pass over or ignore such things, and it is only by tabulating complaints, and demonstrating that it costs more to sustain the turnover caused by them than to remedy them, that the employment department can secure attention.

It is a valuable practice to have the foreman make a definite statement regarding each of their men every month or quarter; but the order requiring this statement had best emanate from the office of the works manager or the superintendent, rather than from the employment department. The foremen feel a direct responsibility to their immediate superior only, and very little if any to the employment manager, unless the latter happens to be a member of the board of directors. It is very much of a task for the average foreman to make up such a report.

In the first place, he is not a clerk and he dislikes clerical work; in the next place, the chances are against his being sure that he knows all his men by name. If he is not acquainted with them personally, he ought to have to make such a report frequently, so that he will get to know them. These reports should be turned over to the employment office to be entered on each man's record, and for investigation of any cases where the reports seem to indicate bad placement of men or that men might well be promoted to better jobs. Foremen will be pretty careful about reporting the latter condition; and no very flattering remarks may be expected. However, some way must be found for getting the men into the places for which they are best fitted. This can be done by transfers or by training.

Transfers

If a foreman finds that he has a man working as a helper, who looks well and who is a good worker, he will immediately be interested to develop him into a journeyman. However, if the employment department discovers that a certain man is better fitted for work that another foreman has charge of, the first-mentioned foreman will almost surely make strenuous objections to the transfer of the man. This is partly because of a survival of the old feeling of ownership in human beings and partly in self-defense. It is customary for a shop manager to speak to his workmen as "my men," and for each foreman in the same way to have *his* men. Unconsciously, this becomes something much more than a figure of speech; it becomes an accepted fact, and one that is not apt to be controverted until an employment department is organized. The self-defense idea is based on the assumption that each foreman has personally trained his men and that they therefore owe him something which can only be repaid by their staying on the job indefinitely. There is likely to be a great difference of opinion about this. A foreman may claim to have "taught so-and-so all that he knows about the trade," but the man may very likely think that the firm never found a man before that could do the work and put up with the interference of that foreman. And the one is just about as likely to be right as the other.

The only solution of the problem of personal ownership is the strong hand of the management. If the works manager says that every man is to be placed where he is most needed, and then takes the matter of so placing the men into his own hands, there is little trouble after the first foreman has threatened to resign unless he can have a given man, and has not

done so when the man was transferred. The feeling of personal obligation arising when the foremen train the men can best be avoided by an organized system of training each man for his job, in the way that the company has found most effective.

There can be but little doubt that each foreman should subordinate his views, in regard to the place where a man may be best employed, to some one who is in a position to see the whole job rather than the portion only that comes within the view of the shop man. The works manager may have to take this problem to himself; but, if he does, he will be almost sure to lean heavily on the advice of the employment department, as that department is most likely to be in a position to know what departments are in need of help and where a given man will do the best work. The works manager is in a position of accepted authority, but in most shops shop opinion in regard to the authority of the employment department is still being formed. Impartial service on the part of the employment office in making transfers is sure to produce resentment on the part of the foreman from whom a good workman is taken. Almost every foreman can readily see that men should be distributed where they will do the company the most good, but very few are broad-minded enough to accept the transfer of a valuable man from their own crews without rancor.

HOLDING MEN IN THE SHOP

Wages and Conditions

Any treatment of the relations between management and men in industry must give serious consideration to the question of wages. When men who leave the company are questioned as to their reasons for so doing, more often than not they will say that they are going to get more money. A little questioning by the employment manager or his representative may show that the additional money may prove to be a saving in car fares paid, or it may be that the change will bring the man near home where he can get his lunch for apparently nothing, or it may be that he is going for less money, but he hopes or expects soon to make more on piece work or on bonus. It may be that he is going to get more, but that he is going to a disagreeable job that he intends to drop just as soon as he gets that additional $50 that he must pay on a phonograph. There are men who make a regular round of shops where, alternately, in one they have an easy time at small wages and in the next they get big wages for hard

disagreeable work. So it is safe to say that every pay roll is made up of two parts: one, the smallest amount for which the necessary help could be got under the best working conditions; the other, the excess paid because of wet, dirty, dusty, and other disagreeable conditions, distance from housing, bad transportation facilities, and a multitude of other disadvantages. The effect of many of these can be fairly well estimated, and the advisability of remedying them can be determined from a profit-and-loss standpoint.

Independent of considerations such as mentioned, the rate of wages usually fluctuates, according to the state of the labor market. Of late years, in response to public opinion, and in rare cases to minimum-wage laws, the minimum wage has been set at something above the lowest level at which labor could be obtained. Public opinion abhors the idea of treating labor as a commodity, since it amounts to very much the same thing as treating men as a commodity. There is a very distinct feeling that a laborer should be paid enough to enable him to maintain the "American standard of living," a rather indefinite term which is usually understood to mean that he shall be able to purchase for his family all the necessities and some luxuries. That is, he should be able to keep a good tight roof over their heads, have a warm house in the winter, food that is plentiful and nourishing, clothing that is warm and lasting and not distinguishable from the ordinary garb of the wealthy, and a reasonable amount of recreation. This very reasonable requisition has been more than filled at some times and has not for any extended length of time been withheld from workmen in this country.

Beyond this, however, wages have advanced in times of scarcity of labor with bounds that were seemingly out of all proportion to the forbearance with which employers have failed to follow the labor market on its downward swings. When there is even a very slight undersupply of labor, it is possible, for those who wish, to put their labor on the auction block and sell it to the highest bidder. At such times it is almost certain that employers are in a position to exact higher prices from the purchasing public, and in order to take advantage of the high market for their wares they pay any demand for higher wages, with only a show of reluctance. In the parlance of the fields, they "Make hay while the sun shines." The injurious effects of this short-sighted policy are too evident to need any discussion.

Just what proportion of the selling price of any article belongs to labor, how much to management, and how much to invested capital and borrowed money, is problematic. So long

as people are so easily influenced by untruths, so easily scared by the fear of things that never happen, there are likely to be serious ups and downs in business. Whenever there appears to be a large margin of profit in any one line of business, there are numbers of people who see an opportunity to make a large profit, and who think they are keen enough to get out before the crash comes. The automobile business is a case in point. The electrical business has had a similar experience.

Wage Rates

As a basis of comparison, almost all wages are now quoted at so many cents per hour. The actual income has to be arrived at by knowing how many hours make a week of regular time, how much overtime, if any, is being worked, and what percentage of the year the work goes on. The hourly wage rate is undoubtedly the most common method of paying for men's work, whether in common labor, semiskilled, or expert. Unless, however, it is coupled with a fairly definite idea of what constitutes a day's work, it is a very inefficient method of paying for labor. If, on the other hand, it is understood that a day's work of 8 hours, for example, covers the laying of 1,200 bricks, then it becomes virtually a straight piece-work rate in which slight daily fluctuations are covered by the day rate. Every man then knows that if he falls below that rate he will have to look for another job, unless the foreman is virtually willing to make him a loan of the money represented by his failure to make the pace, with the expectation that the loan will be repaid by more rapid work some other day in the immediate future.

More often than not, the day rate simply indicates the inability of the employer to say what he thinks his workmen should accomplish in a day. This inability comes from a lack of knowledge of just how the work should be done. The importance of knowing the different methods by which work is done is illustrated by a piece of work in a machine shop; for example, a planer job that requires a considerable amount of time for setting up. The first time a job of this kind is to be done it may come into the shop when all the other planers are running on simple flat jobs requiring a minimum of blocking and straps. The time required to complete the job is recorded. The second time it comes in, all the other planers may be using large quantities of blocking, and it may take twice as long to do the job as it did in the first instance, because of the time spent trying to find suitable tools with which to set it up, and because it was finally set up so that only the most careful cuts could be taken

for fear of tumbling the whole job down. Of course, when such a piece is to be manufactured regularly, there will be a cradle provided into which it can be set with only a few minutes' work for leveling, and it will be firm enough so that cuts up to the limit of the strength of the piece can be taken. Then the employer can make a piece-work rate that will undoubtedly be fair; but then he has reached a basis where he can also tell from the time slips whether the operative is doing a full day's work on an hourly basis. The opportunity for a highly skilled man to earn a great deal of money for the firm was in the crude first stages, when he had to use his ingenuity to make whatever tackle he could find hold the job securely, without using a long time to find it.

Day work in itself offers incentive to effort only as the day wage is high enough so that the workman knows perfectly well that no one else will give him so good a job if he leaves this one.

Such incentive, however, has no permanent value. Either other employers raise their wages to come up to this higher standard or else the men grow to get the idea that because they continue to get this wage they are so valuable that the first employer will not drop them. So to the lure of a higher wage there must be added the negative inducement of a constant, though small, stream of men being discharged because they do not keep up to the company's standards of production. A man can keep busy doing a very small amount of work. He becomes a putterer, and a putterer in the very great majority of cases only delays production. There is very little work that is really improved by being done better or more closely to size and with a better finish than is prescribed by the management. The man who grows to feel that it is very important that his work be exactly so, begins soon to exaggerate his own importance and to feel that he should be pressed less and less for quantity production.

The cure for all of this tendency to laziness, and to self-importance is some form of wage payment that will put a premium on production. However, no system of this kind should be installed without first weighing carefully the advantages to be gained against the increased cost of inspection and the increased danger of spoiled work.

NON-FINANCIAL CONSIDERATIONS

Hard Work

Money earned, especially if the workman knows constantly that he is liable not to be able to keep up his wage unless he keeps up his work, has a strong attraction. However, it is very true that other considerations weigh more than money at times. First of all, men get tired and worn out, not with too hard work, but with too much monotony. Almost always when a man says that the work is too hard and that he must leave the job for an easier one, the real reason will be found to be the sameness of the job, and his weariness is mental rather than physical. This is just as bad for the firm, however, as though he really were made sick by excess of work. Of course there are cases where physical work does exhaust, as, for example, in shoveling coal, digging ditches, etc. A bystander, watching a ditch being dug by hand, and especially on a municipal job, is very apt to have something to say about the laziness of people who work for the government. What he should say is that it is very inefficient to employ men to dig, if there is any other way of getting it done. No one can work continuously at it, to say nothing of keeping up a pace that seems at all hurried. It is very likely that the average man could do all the work there is in him in a 6-hour day, and that is about what he does as it is. The rest of the time is spent straightening up and getting the kinks out of his back, lighting a pipe, getting a drink of water, and other little subterfuges which really express a necessity rather than any desire to soldier on the job.

Disagreeable Work

When there is a choice, men do not take jobs that are dirty, dusty, wet, monotonous, heavy, or dangerous, without greater rewards of some kind or other. Men are not adapted or intended by nature to be beasts of burden, and they cannot work continuously at heavy work. Dusty work is not only disagreeable but it is likely to lead to illness. Almost every one has some bronchitis, and we always will have so long as we live in cities instead of in fresh air. Bronchitis is aggravated by dust, then pneumonia is easily acquired, and from that to a weakened system that lets the tubercular germ multiply is only a step.

By a dirty job is meant one that makes it difficult ever to get clean except by taking a vacation. For example, a man working in a machine shop on cast iron continually is likely to find that it penetrates his clothes, works into the lines of his

hands, fills his nostrils, and undoubtedly gets into his lungs. The same is true of a blacksmith's work, especially with a soft-coal fire. Men who take such jobs have to associate outside working hours with those who are not fastidious about cleanliness, or else with others who cannot make themselves presentable. Some of these dirty jobs cannot be eliminated in the present stage of the art, but such of them as can, are likely to prove move profitable for the change. The greatest appeal to Americanism comes through pride, and we cannot expect people to be proud of their country unless they can hold up their own heads in any society.

Wet jobs are disliked only as the wetness is harmful to health, or as it is a dirty wetness. There is seldom any trouble getting candidates for the job of life-guard at the beaches, and of all jobs there is none wetter. On the other hand, a man who slops around all day and all the year and possibly for a lifetime in a tannery, always wants an extra reward for doing it, above what he would take to work at a nice, clean, comfortable job.

Danger

Dangerous jobs exact a premium for the worker, unless there is something about the job that appeals to a man's vanity. Structural-steel workers have a very dangerous calling, part of which is paid for in the pay envelope and part of which comes from the admiration of the crowds that gather around and watch and appreciate the performance. The same is even more true of circus performers, riggers, and other men whose work depends on sureness of foot and hand, and whose work is in the public gaze.

Most dangerous jobs in manufacture have nothing of the spectacular about them and consequently have to be paid for in cash only. Some of them conceal hidden dangers and are accepted by workmen without any thought that they are dangerous. Some become dangerous only at times, some only through the carelessness of fellow workers. For example, a man may work under a traveling crane for years and never even witness an accident. There may be a change in the personnel of the gang that attends to moving machinery and castings, and the new gang may not understand the business, or they may be careless, and a casting may be dropped directly on the man, killing him or maiming him for life. Every such accident affects the labor turnover. If the men who witnessed the accident do not take the news home to their families, the latter get it from the newspapers and then secure all the details from the wage

earner. Then they set up a process of begging him to be careful which turns into nagging, and the man is soon ready to look up a new job, even if he has to take a lower wage to get it. This may seem a small thing to increase the labor turnover, but it should be borne in mind that these things come very close to workmen who have nothing saved up and whose only hope of keeping out of the poorhouse is a constant job. Of late years, the workmen's compensation laws have improved conditions somewhat; but none of them provide for all of the loss sustained, for fear of encouraging malingering, and it is only very recently that serious consideration has been given to any means for training industrial cripples for worth-while jobs. Every wife who sees a cripple on the sidewalk selling pencils, looks on him as a warning of what her husband may come to, and there is little doubt but that such things have a strong influence and rightfully so.

Comfort of Mind

Mental anxiety, fear, and worry seriously affect the efficiency of workers. They prevent men from doing their best work. Whenever a man who has been in the habit of doing well begins to lose his interest, and decrease his production, it is wise to inquire into affairs which may affect him mentally as well as physically. It may be that some one in the shop is annoying him, it may be that he owes money that he cannot see his way to pay, he may be having trouble at home, he may have a son that is causing him anxiety. Instead of discharging him out of hand, which only aggravates his trouble, it is better to adopt a sympathetic attitude and try to discover just what is at the bottom of his troubles. It is very possible that the employment manager can find a way to reassure him and help him out of the predicament he is in, or which he fears he is in, as happens in the larger number of cases.

The surroundings in which men are placed have a greater influence on their productivity than many imagine. If a man is not sensitive to his surroundings, that in itself should be reason enough for questioning whether work that requires mental alertness should be entrusted to him. That is, instead of accusing men who are fastidious about their surroundings of being eccentric, it is more to the point to realize that men who are responsible for things requiring thinking capacity must have a considerable degree of sensitiveness themselves.

The surroundings which affect people may be the room, the outlook, the atmosphere, or the people with whom they are

thrown in contact, or whose voices they hear. For example, in a large office one man broke up the morale of the whole force because, not being used to working among others, he raised his voice so high when telephoning as to cause a hush all over the room. When he was placed in a small room, he used his natural voice. In this case the man's personality was of the best; simply he could not get used to telephoning where he had to listen closely to get the other man's conversation. There are, however, many cases of men who are discordant who do not intend to be and whom it is almost impossible to dispense with and feel that justice has been done—men whose intentions are of the best, but who through lack of knowledge of English are constantly saying things that lead to misunderstandings.

Then, there are the men who apparently deliberately intend to wreck the morale of the place; who go about misrepresenting each person to others, who aggravate each man's known animosities by sly statements that are founded on fact, but which are given a very different sound from that intended. For example, a works manager had a favorite method of introducing a topic on which he wished an opinion, by saying, "so-and-so says you are all wrong about it," when as a matter of fact the first man had merely raised the question as to the most politic method of doing the thing. Things like these irritate men and finally bring them to the point where they are ready to look with favor on other positions which otherwise would not be attractive. The only way to handle such situations is to get to the root of the matter and insist that all private grudges be brought into the open and that all idle and meaningless gossip be omitted. If two men who have antipathies are brought together and the trouble is traced back to the thing that started it, it is seldom that the difference can not be settled, by an appeal to the men's loyalty to the company. It does not take a large force to have enough of these feuds going on to make all the difference between a comfortable profit and none at all, due to the way such men use their authority in the company to put some other man in a wrong light with the management.

Tenure of Job

Tenure of job is of great importance to men with families to support. There is a very decided and well-founded desire on the part of most firms to have as large a proportion of married men in their employ as possible, and yet some of them overlook the fact that such men will always choose to work for a firm that is known not to be hasty about dismissing employes. For

this reason, if no other, a reputation for fairness toward employes is worth considerable effort. Every man who is turned out without just cause, or who is dropped because of a slight letting up of orders, tends to reduce the desirability of the job for some one else. The common practice of letting men without dependents go first in case of business depression is an excellent one, as it gives men who have dependents a much greater confidence in their own future.

It is probably not a good idea to make tenure of job anything definite. That is, removals of men who turn out to be destroyers of morale and who cannot be made to see the falsity of their position should always be possible. Men should have no chance to feel that they can slacken their efforts to do a good day's work and still be retained on the pay roll. However, it should be possible for any man to feel that the mere fact that he is approaching a given age does not make his working days more precarious.

The establishment of an age limit for entrance into employment or as a time when a pension system is to go into effect, with compulsory retirement, is not altogether justified; because the number of years of a man's life has such a variable relation to his mental and physical condition that, with a fixed retiring age, one man may be carried long after he should have retired and another may be cut off years before his work should have ended. It is a fact, however, that a man's physical powers begin to recede just about as his mental powers grow. Men can seldom stay in active athletics much beyond the age of thirty. At thirty they are only developing the power to reason and think straight. They may be as intelligent at eighteen as at thirty, but they have not had an opportunity to gather the experience which is needed to round out a man's education, and despite all the advances of science we still have to work from experience rather than from pure reason.

It seems as though the time of entrance into an organization should be determined by the work which the man is to do. If the work is physical labor, the determination should be made by the medical department; if mental, by the man's own past history. Men's minds grow in capacity with added experience, and it is only the tendency to cling to older associates and to turn away from young men which makes a man grow old mentally. If a man of mature age keeps up his association with the younger men, on a plane of equality, there is no good reason why he should not continue to grow in value to his employer so long as he retains his physical health.

The theory advanced by some, that if a man has not made his mark in the world by the time he is of some certain age, anywhere from forty to fifty, he is a failure and should be debarred from employment altogether, is another thing that is hardly justified by experience. Very few men, as compared with the great number, make a success of business at any age. Very few men who would be successful in business for themselves would be satisfactory employes. Ability to make money appears to have little relation to intelligence, mechanical ability, or to any other measurable attribute. Men over 50 years old do work and must work. If they are so unfortunate as to have become as old in spirit as in years they may be content to take gradually less and less pay and to slip into oblivion. If on the other hand they keep young in spirit, they become the advisers of the younger men, and the ones to whom every one instinctively turns for help in new and untried positions. Again, it is a poor organization that does not effectively utilize all the abilities of each employe. The physical energy of youth, the studious attitude of some, the belligerency of one race, and the servility of another, the experience of middle age, and the counsel of advancing years are all a part of the world in which we live. If all are not used, we are just as improvident as those who harvest only the largest fruit and leave the rest to rot because it is not easy to pick.

LABOR TURNOVER

Methods of Computing Turnover

When the loss caused by a too rapid flow of workmen through the shops first began to attract attention, the first discussion of this matter bore principally on the great cost of rapid turnover to industry as a whole, because of the necessity of training a great many more men for jobs than seemed to be necessary. This discussion did not, however, take into account the employe's side of the question. It did not take account of the lack of means for mastering any trade, and it failed to call attention to the fact that men really need to know how to do more than one thing because of the rapid changes in modern business methods.

Briefly, the statement was made that on the average men changed jobs oftener than once a year, and that if they stayed on each job for five years instead of one, the total cost of training or breaking in new men would be reduced in that proportion. If the cost of changing men on a job was some certain

amount, as, for example, $50, then in shops employing any considerable number of men the saving would be easily computed and would be a large amount.

In a shop employing 5,000 men, a reduction in turnover in the proportion mentioned would amount to a saving of $200,000 per year. This in itself would not be a very large profit on the business which a shop of that size should do, but as an addition to its regular profit it would be well worth considering.

In times of great business activity when profits are large, the turnover will greatly increase; for the different shops will bid against one another for help, each manufacturer apparently being afraid that the opportunity for profit will pass before he can get his share. On the other hand, in time of depression, low labor turnovers may be expected; for men do not so readily leave a job when they are not sure that they can get another. Thus, while an annual turnover of 200 per cent. might not be considered abnormal in times of great business activity, a turnover of 100 per cent. in dull times might be considered an indication calling for careful investigation.

Computation of Labor Turnover

There are three principal methods of figuring labor turnover, and there are a number of minor variations. The only purpose of computing turnover is for comparison with past records and with those of other shops and offices. The different methods give different results, and for this reason there is an advantage in coming to some agreement as to what method shall be used.

The percentage of turnover is in all cases the ratio between the average working force and the number of changes in the personnel during a year's time. The determination of what constitutes the number of changes is the principal cause of disagreement in the results of the different methods. Some computers consider the number of changes to be the number of persons leaving the firm's employ. Some prefer to use for calculations the number of new employes taken on, and others prefer to use the number of replacements. Those who use the number leaving say that it is the proper method, because all the efforts of the employment department are centered on getting the kind of employes that will stay and then making it wise for them to stay, and that, therefore, every man who leaves, whether he is discharged or leaves on his own account, is a discredit of the employment department. Those who use the number of men hired favor that method because, they say, the cost

of getting these men is a part of the cost of running the department, and the cost of training them is a charge against the employment department. Those who say that the number of replacements should be used as a basis of calculation agree with those who use the number of men hired, but add the proviso that only those men should be figured into the labor turn over who are hired to replace men leaving. For example, if the shop is growing in size, they do not feel that it is fair to have the labor turnover increased and for the employment department to accept a charge against its efficiency, when the change is caused by the growth of the company's business.

In a case of a growing organization, the results of figuring the turnover by each of the three methods mentioned are shown in the following calculations in which it is assumed that there are 1,000 men on the pay roll at the beginning of the year, 1,500 are hired during the year, 1,000 leave, and 1,500 are on the pay roll at the end of the year, the average force being 1,250.

By the first method, the percentage of turnover would be:

$$\frac{\text{Men hired}}{\text{Average force}} \quad \frac{1{,}500}{1{,}250} = 120 \text{ per cent.}$$

By the second method,

$$\frac{\text{Men leaving}}{\text{Average force}} \quad \frac{1{,}000}{1{,}250} = 80 \text{ per cent.}$$

By the third method,

$$\frac{\text{Men hired to replace others}}{\text{Average force}} \quad \frac{1{,}000}{1{,}250} = 80 \text{ per cent.}$$

Now suppose that business is depressed so that it is necessary to reduce the force the next year, and that there are 1,500 men at the beginning, 1,000 are hired, and 1,500 are lost or dropped, leaving 1,000 at the end of the year. Then, calculated by the different methods, the percentages of turnover would be:

By the first method,

$$\frac{\text{Men hired}}{\text{Average force}} \quad \frac{1{,}000}{1{,}250} = 80 \text{ per cent.}$$

By the second method,

$$\frac{\text{Men leaving}}{\text{Average force}} \quad \frac{1{,}500}{1{,}250} = 120 \text{ per cent.}$$

By the third method,

$$\text{Men hired to replace others} \quad \frac{1{,}000}{1{,}250} = 80 \text{ per cent.}$$
$$\text{Average force}$$

From the foregoing it will be seen that the first two methods give opposite results under changed conditions, but that the results of the last method are alike for equal changes, whether the change is an increase or a decrease. From this, the last method seems to be much the fairer to the employment department, whose work is judged by the rapidity of turnover shown by its figures. Moreover, the method seems the fairest to the shop, as it is by no means the fault and not always to the credit of the shop that business falls off or picks up. However, labor turnover figures are for a guide and a warning only.

Whenever business is going down in general, the labor turnover necessarily decreases so far as the number of men leaving of their own accord is concerned and increases in the number of men discharged or, laid off. When business in general is on the mend, labor turnover increases, because of the rashness with which firms coming out of a depression bid for help.

Further variations in figuring turnover occur in the exceptions from the numbers in the numerators of the fractions shown in the foregoing calculations. Almost every one leaves out the number of employes dying, as being outside the power of the shop or employment office to change. Some leave out, in the case of female employes, those leaving on account of marriage, or on account of approaching childbirth. Exception is also sometimes made in the case of young people who leave because their parents are moving from the city and they are obliged to go too. Then, in some lines of business there is an emergency force hired for a brief period only, as in a department store around Christmas, and in hat shops near the close of the season's work. It seems reasonable to consider that when any one hired for a definite period fills out that time the employment department has a perfect record in respect to that case. Certainly the employment department should not be charged up with inefficiency because the period for which the help is wanted is less than a year. In general, when figuring employment-department efficiency, it seems right to leave out of account all cases in which no effort of the employment department could have kept the man who leaves. To be sure, when employes die or their parents move away, their successors have to be trained for the job, but such employes are in the same class as those who are hired and trained for the work

RECORD OF TURNOVER

COMPANY _____ DEPARTMENT _____ MONTH _____

FOREMAN _____ YEAR _____

ENTRANCES

NEW

1	2	3	4
Experienced	Learners	Laborers	

RE-EMPLOYED

5	6	7	8
Experienced	Learners	Laborers	

TRANSFERRED

9	10	11	12
Physical Reasons	Promoted	Failed	Departmental Fluctuation

EXITS

LEFT OF OWN ACCORD

WORKING CONDITIONS

13	14	15	16	17	18
Wages	Heavy, Wet or Dusty etc.	Ill Health	Monotony		

LOCATION

19	20	21
Family Moving	Housing Conditions	

OTHER REASONS

22	23	24
		Unkown

DISCHARGED

25	26	27	28	29	30	31	32	33
Careless	Lazy	Incompetent	Unreliable	Liquor	Trouble Breeder	Insubordinate	Misconduct	

LAID-OFF

34	35	36	37
To Decrease Force	Physical Reasons	Temporarily Employed	

TRANSFERRED

38	39	40	41
Physical Reasons	Promoted	Failed	Departmental Fluctuation

UNAVOIDABLE

42	43	44	45
Pensioned or Superannuated	Marriage (Female) or Pregnancy	DEATH: Exterior Causes	DEATH: Occupational Causes

Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46 TOTAL ENTRANCES	47 TOTAL EXITS	Date
1																																															1
2																																															2
3																																															3
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To Compute Percentages DIVIDE TOTALS BY "DEPARTMENT AVERAGE for MONTH"

Number of Employees in Department on Last Day of Last Month _____

Last Day of this Month _____

Department Average for Month _____

they are to do because of the growth of the firm's business. A form of record showing daily and monthly labor turnover and the causes is shown in Fig. 15. A form of summary of turnover records is shown in Fig. 16.

Day
Night _____ 193___

TURNOVER BY CLASS OF WORK AND CAUSE

	Cause of Leaving	Class of Work					Length of Service					Sex		Color		Totals	Percent of Turnover Due to each Cause
		Unskilled	Semi-Skilled	Skilled	Foremen and Assistant Foremen	Shop Clerical	Less than One Month	Over One Month and less than Six Months	Over Six Months and less than One Year	Over One Year and less than Five Years	Over Five Years	Male	Female	White	Colored		
Discharged	Careless, Unreliable, Lazy																
	Incompetent																
	Insubordinate																
	Quarrelsome																
	Irregular Attendant																
	Miscellaneous																
	Total Discharged																
Laid Off	Physical Reasons																
	To Decrease Force																
	Total Lay Off																
Voluntary	Pay (More Money etc.)																
	Work Conditions Dusty Dirty																
	Lives too far, etc.																
	Account Night Work																
	Poor Health																
	Unknown																
	Miscellaneous																
	Total Voluntary																
Died																	
Total Exits																	100
Average Working Force																	
Turnover																	

New Employees: Men – Women –

Remarks

FIG. 16

Methods of Reducing Labor Turnover

It should always be borne in mind that it is possible to reduce labor turnover too low for the good of the shop. A very low rate

is likely to mean that the average age of the employes is too great, as men lose their desire to go from place to place as they grow older. It may also mean that not enough production is called for, that the foremen are too easy with the men, that discipline is not maintained, or that higher wages are paid than circumstances justify; all these things are possible and costly. However, very few shops have to consider turnover from this point of view, as almost all of them suffer, whether business is good or bad, from an unnecessarily high turnover.

It should also be borne in mind that the employment department by its own efforts is seldom in a position actually to reduce labor turnover, and that, as it is usually an advisory department, a part of the staff rather than the line in the organization, it can only present reasons why things should be so changed as to make the needed reduction. It is also safe to assume that no one thing will cut down the turnover to any great extent. There is no panacea, and there appears to be no way to predict absolutely what will be most effective in a given case. Among the many things that have been tried with varying degrees of success under different conditions are combinations of employers, various forms of welfare work, and education.

Combinations of Employers

One of the favorite means which has been tried for reducing labor turnover, especially in moderate-size cities, is a combination of employers. Such a combination is an association of employers who are willing to pledge themselves that they will not hire one another's men without the permission of the former employer. Practically such a condition pertains in the government service, where there is a rule that no one can change from one department to another except at the same salary, and with the full knowledge and consent of the former department, and that any one who changes is not eligible for an increase in salary for 6 months after the change.

There are two things that make it almost impossible to maintain such an agreement under ordinary business conditions. One is, that in times of scarcity every member suspects that the others will take some chances to get help. He therefore believes that, the action of none of them being entirely dependable, no one will dare to take action against another who interprets the agreement liberally to suit his own needs. Consequently, when one employer finds it necessary to recruit, he takes whatever men apply and say that they will not again work for the other member, whose shop they were in up to that day. The other

thing that makes it impossible to carry out the agreement between the members is that it gives so great power to an unscrupulous foreman, that abuses are likely to turn every one against it. For example, if a man is hired in one shop under an agreement that if at a given time he is worth more money it will be given him, and he is passed over at that time and given no satisfaction, he should have a right to go out and get a job wherever he can. If his foreman tries to prevent his getting this job elsewhere, then the system is being flagrantly abused and almost every one except the prejudiced foreman will see it in that light. As a matter of fair play, it seems that it should not be necessary for him to have the approval of his present boss before getting a new job. Most foremen are entirely human, and they will find ways to show that a desirable man is desirable only for the job with which he is occupied.

A more legitimate combination of employers is one that sets standard rates for certain classes of labor, as, for example, a uniform rate per day for men who shovel coal over the sides of gondola cars, a given piece rate for knitters of men's socks, or similar definite jobs. Such rate setting is done successfully inside the shop, in fact it is one of the first jobs of the employment department to call attention to discrepancies in rates of pay in different departments. But, where different firms are concerned, such arrangements are very difficult to keep going after they are started, for reasons similar to those that apply to the form of employers' combination already described. Firms will enter the agreement and then after a little time promote new employes and raise their wages so soon as practically to violate the spirit of the agreement. An illustration of such a situation was presented by the operation of the Shipping Board during the World War. In some shipyards laborers received one rate and helpers to other mechanics a higher one, and many yards took advantage of the opportunity to rate most of their laborers as helpers, thereby obtaining an advantage over the firms that followed the spirit of their instructions.

Community Employment Bureaus

The only circumstances under which combinations of employers are likely to be successful are in small communities in which all the shops that compete for labor put their employment work in the hands of a community employment department, and standardize their requirements exactly as is done within a single establishment. From the ethical standpoint, no objection to this form of organization can be made except when

it is used to prevent earned increases in wages or promotion. Unfortunately the same jealousies and selfishness crop out in all these associations as in single shops, and are less likely to be controlled. Inside one shop, there is the possibility that the superintendent will take hold of a case where one foreman refuses to allow one of his subordinates to be promoted to a better job in another department, and will make the promotion. In an association of shops this is not possible, and superintendents will accuse one another of stealing help if overtures are made to any one to move from one shop to another; in other words, there is great danger that the growth and prosperity of a small community may be jeopardized by the selfishness of one superintendent, unless all the others take a broad view of the situation and insist on enough circulation of men from shop to shop so that stagnation will not set in. The moment a man comes to feel that he is helpless and that he cannot move to another shop without the permission of his own foreman he feels a resentment against the town for making such a condition possible. The only ethical and profitable combination employment department is one that shows sufficient self-restraint to give employes large choice as to working places. The preferences of the employes will show plainly their opinions of the different firms, for there will invariably be one shop in any town which is considered the best place to work in by the majority of the workmen and another that is considered the least desirable, with the rest rated in between.

Welfare Work

In shops where the labor turnover is thought to be too high, an effort to reduce it is often made by resorting to so-called *welfare work*. This term has come to have a meaning much broader than it should. Its real meaning is work done to direct employes to a better use of the money which they earn, toward thrift, cleanliness, and good home life; in fact, an attempt to get workmen to enjoy the things which generations of restraint have made enjoyable to the so-called higher circles of society. The great difficulty is to eliminate paternalism; and the greatest difficulty in doing that is to get people who are paternal to realize what they are doing.

Paternalism may have a great range of meaning. It simply means *fatherly control*, but in general it conveys the idea of a father who retains his legal control over his children and acts the part of a benevolent despot. There are a great many people who like to be treated in just that way, but it is not a

wise father who retains this control and thinks for his children up to the day they are of age and even afterward. Their own self-control and initiative need encouragement and development, which they do not get unless paternalism is exercised with good judgment. The situation in a shop may be compared with that in Cuba, where the United States government began in a very paternal manner but gradually relinquished control of the native government until finally it was possible to let go altogether. So, in the shop, paternalism is justified only as it is helping people to get along without it.

It is very difficult for a man who has the money-making instinct to sit still and see other persons fail to be thrifty. He feels that it is part of his duty to reform them. By *reform* he means, of course, making them like himself. They may envy him his wealth, and yet down in their hearts they may despise him for the way in which he has accumulated it. By his very position, he is unable to get their attention to his ways of becoming wealthy. On the other hand, a great deal of what is done under the name of welfare work is acceptable to employes under some other name, and under leadership rather than compulsion. If they see one of their number prosper and show signs of it, they are quick to try the same thing, whether it be a get-rich-quick scheme or somethng legitimate; but let the owner of the shop propose that they invest in the company's stock and he will find that they suspect all sorts of schemes on his part, from a plan for getting their hard-earned savings away from them to a scheme for getting them tied up to the shop so that they cannot afford to take any other job. This fact seriously pampers business executives in their participation in legitimate welfare work.

Some plans for welfare work that have been tried with varying degrees of success are described in the following pages.

Mutual Benefit Associations

Probably mutual benefit associations have the highest percentage of success of any of the activities that come under the head of welfare work. They are very much alike in their methods, the variations appearing to be immaterial. From study of many of them it appears that the elements in common which seem to lead to success are: (*a*) Control by employes; (*b*) small frequent payments; (*c*) moderate benefits; (*d*) payments large enough to allow occasional dividends and to render extra assessments unnecessary; (*e*) limited social activity.

Control and management by employes seems to be the most

important essential. Most companies allow the elected officials of the association to spend a reasonable amount of time during working hours in collecting dues and making disbursements. Some companies go so far as to collect the dues by taking them out of the pay envelope, but this has its disadvantages. As soon as a man finds something taken out of his pay envelope he gets to think of his pay as what he finds in the envelope and to forget that what is taken out ever was his. Consequently he soon loses interest in the association, and allows it to be run by whatever clique may happen to have control at the time. When a man receives his money in full and then pays out even a little of it under agreement, he realizes plainly that it is for something in which he has an interest and in which he may take a hand. It is found very helpful not merely to have employe control, but to provide in the constitution that employe control shall rotate; that is, that all the officials shall hold office only for one or two terms, enough staying in office to pass along the necessary traditions to the next comers.

Frequent payments are desirable in order that they may not be easily forgotten. Some will want to pay up a year ahead, some may offer a 5-year payment, but the great number should pay at least as often as once a month, and in some ways it is better that they should pay as often as the pay day comes around. There will be a temptation to make the pay clerk the collector for the association and to have him collect as he pays, but this slows down the paying off of the help too much, besides not letting the employe have the money long enough to realize that he has had it.

About half the successful associations collect 25 cents per member, once a month (pre-World-War rates). This rate allows payment of about five or six dollars a week during illness and a death benefit of $100; and, if the business of the association is well cared for and no epidemics occur, it will allow a slight accumulation of surplus, or an occasional dividend back to the employes. Payment of dividend only to those who have been members for some certain length of time, or adjustment of the dividend according to the length of time each member has been contributing is advisable, as equal dividends to all is not fair to the older members who have really made the dividend possible. It is undoubtedly wise to pay occasional dividends if possible, and actually to *pay* them, not by remission of a month's dues, but by payment in cash from the treasury.

Most organizations have a proviso that the total payments made to any member shall not, when added to all that other

organizations contribute, amount to as much as his regular income. This is to prevent malingering; but it is not always enforceable, as men do not always let all of their affiliations be known. Under workmen's compensation laws, certain sums are paid in case of accident, and the association will be called upon to make its usual payments. If, then, the total the man receives slightly exceeds his usual income, a certain leeway for actual loss to the family may well be allowed, as a man's wages are by no means all that he contributes to his family's comfort. He undoubtedly does much around the house that will have to be paid for if he is not able to do it himself; there will at least be walks to shovel and ashes to take out, and little odd jobs around the house which cost a great deal of money when done by a plumber or tinsmith. Then there are almost always doctors' bills, extra expensive foods and medicines, which are not covered by the compensation laws.

The death benefits of employes' benefit associations are very seldom intended to amount to more than enough to pay funeral expenses. This may seem like very little to those who carry their insurance by the tens and hundreds of thousands, but to a workman's family it is worth a great deal not to have this additional burden just at a time when the world looks darkest.

The statement that only a limited amount of social activity is desirable in connection with a mutual benefit association may seem at first sight to require explanation, but experience has shown it to be true. People who work in the same shop necessarily see a great deal of one another, perhaps more than is good for them, during working hours, at noon, and going to and from work. Their homes often are widely scattered, and any attempt to bring them together in a social way, in the evening or Saturday afternoon, or on a holiday, finds them more anxious to have the time to spend with friends whom they cannot meet every day.

The exception to the rule limiting the social activities of welfare organizations occurs when the employes of a shop by themselves constitute a whole town or village of enough size to justify socials among neighbors who live near one another and in a place where moving pictures do not form a serious competition. In such a community, every one plans for, and looks forward to the next dance or entertainment. Every one goes and the whole effect is good, except for the slight loss in production for the few days before each party. Improvement in the morale of the whole body of employes is usually worth a great deal more than this loss, however

Group Insurance

It is almost inevitable that the rate of labor turnover will be lower among the members of a mutual benefit association than in the rest of the shop force. This is not altogether because of the association, but more likely because those to whom such an association appeals are the type of people that stop and think before they leave a shop. Whatever the reason, the fact remains that labor turnover is lower in this class of employes than in others, and because of this the management may determine to try one stage more of progress by taking out a blanket policy of insurance on the whole shop force.

The reason for this appear to be as follows: (*a*) If a small amount of insurance is good, more will be better. (*b*) Insurance costs less at wholesale than at retail. (*c*) Insurance companies, knowing their business as they do, must be safer and more dependable than amateur associations. (*d*) The company can put in its credit, and some money, and give each employe an insurance policy at a very liberal rate, thereby doing good for the workmen and gaining credit for itself.

Most workmen carry less insurance on their lives than they are worth to their families. A workman who averages $1,000 a year through his life is nearly as good, from a purely financial standpoint, as an investment of $20,000 at normal rates. Moreover, he has a chance of some day being worth more than the thousand dollars a year. If he invests this money in bringing up a family of children, he may be looked on by his employer as a thriftless chap with no ability to save his money, whereas these children may in 20 or 25 years prove to be worth a great deal more than any life insurance that he could possibly buy.

The second assumption, that insurance costs less at wholesale than at retail, is also true, if limited to the cost of insurance; if it takes in the cost of selling the insurance the statement may not be true. Very large policies may not cost a great deal to sell, but policies moderately large as compared with the insured's income do require a great deal of labor and watchfulness to keep them in effect. The mere fact that a firm makes each employe a present of an insurance policy does not mean that the policies will be kept up. To be sure, if the employe is willing, the paymaster may take out the premium each week or each month, and the policy may be continued in that way; but labor turnover comes into play again, and each man who leaves the shop may reasonably be expected to give up his policy.

In the case of the mutual benefit association, the amount

paid in is so small that no one ever suggests getting his money back; but if the corporation is handling the insurance the chances are very strong that some one will put the matter up to the management and some restitution will have to be made. Such a condition is in many cases provided for in advance by giving each man an opportunity to carry on such part of his insurance with the covering company as his premiums have so far paid for, or, by increasng his premiums, to carry as much insurance as before. Most such policies are, however, issued without physical examination by the issuing company. If the employer has a medical staff and a system of physical examinations, then the policy may be issued on a basis of the excellence of this examination and on its frequency; but the greatest value is in the fact that such a company examination makes certain that men will not be placed on jobs that will aggravate their ailments if they have any.

It is doubtful if there is any very special drawing power in insurance, whether of the professional group type or of the mutual association type. On the other hand, the effort toward promoting such insurance is likely to be resented as being too paternal. If the insurance were made optional and only sold to those who want it, then all the expenses of sale would have to be borne and the cost of insurance would be very little less than if separate policies were sold. More than that, it would be necessary to allow the insurance company's agents access to the employes during working hours. The fact that the employer pays some part of the premium himself has very little effect on his employes. They usually feel that they would rather have the money and freedom to spend it as they please.

All in all, it seems very doubtful if group insurance, good as it is, has any decided influence in making any given job any more attractive to employes.

Seniority System of Promotion

A definite line of promotion and seniority rights is a favorite method for promoting low labor turnover, especially among railroads and other public service corporations. This system presupposes fitness, or rather it demands fitness, for the rule is inexorable. If a man cannot do the job to which his seniority entitles him, he is automatically shunted, either out of the service altogether or into some place off from the main channel of promotion. The system proves to be very effective, especially where provision is made so that men can obtain what practically amounts to a leave of absence without loss of seniority. This

leave is sometimes as long as six months. If a man sees a job that he thinks is better in some other line, he can go and try it for that length of time, then, if he discovers that the old job was better, he can go back with his rights of promotion unimpaired. This rather loose string on a man is a very fortunate provision, because the seniority thus becomes a privilege instead of a penalty. The system is not, however, adaptable to all organizations, because some have so many parallel lines of progress that no one knows whether he is being promoted or demoted. For example, in the manufacture of wire and wire specialties, no one can be sure whether a transfer to or from the black-wire work to galvanized or to cold-drawn work is a promotion or not, except as it is revealed in the pay envelope.

In view of the success of the railroad plan of seniority, it seems as though steps to map out lines of progress so they will be apparent to workmen would be a great advantage to any shop. Unless a man has something to look forward to, he becomes an old man in the company long before he should. If he knows what the next step in his progress should be, he has no excuse for not fitting himself for it.

There are two flaws in the seniority system, however, which should not be overlooked. One is the damper which it puts on the highly intelligent man who might, on a purely merit system, rise much more rapidly than he can go with the current. He feels that waiting for dead men's shoes is too slow for him, and he gets out and goes elsewhere. The other objection to the seniority rule is that it puts so great a premium on staying with the organization that men are more inclined to hang together to get their wage increases and other advantages than they are in a shop where there is a more active flow of men. This is equally true whatever the means of reducing labor turnover. The more desirable the shop as a place to work in, the greater the tendency to unionize from within. If this tendency is confined to the shop itself it is not a bad idea, in fact it is being cultivated in the form of shop committees, etc., by many large and prosperous firms with a considerable promise of success. It has been said that a strike is a compliment to the firm as indicating that the workmen prefer to hang together and lose some time from work rather than give up their jobs individually and secure others.

Hours of Labor

So much has been said about the 8-hour day, that it appears to the public mind to have an importance that it does

not possess in the minds of workmen. Length of hours is of importance in two principal directions; the first, as to the fatigue from which a man will recover over night; the other, the demand of his social circle.

Fatigue

Fatigue may be either mental or physical, or both. We usually think of physical fatigue only, when considering shop conditions, but there are a great many shop jobs that require as high an order of intelligent concentration and mental effort as any in the office. Physical exertion does of course use up energy. If it uses up more energy than food and sleep replace, then the man is wearing himself out. This is not merely his loss or that of his family. It is a loss to the firm for which he works, for it inevitably shortens his working life. Fatigue is not altogether a matter of the amount of work a man does, as the firm has no control of the food with which the waste is to be replaced, neither can it control his digestive apparatus, nor regulate the sleep that he shall take. A great deal has been done by newspaper and magazine articles to promote good health, but much of this work has been undone by the ability which large wages have given for men to eat expensive and indigestible dishes, and expensive habits of the palate are not easily overcome.

In one way, a large amount of hard manual labor may have a less unfavorable effect than a moderate amount; when a man gets home at night tired through and through, he gets to bed and to sleep before the half-tired man has made up his mind just how to while away the evening. Where great fatigue is experienced, and especially where the fatigue is mental, rest periods at somewhat frequent intervals have been found advisable. There is no stated period of working and of rest that is best for any two men, or best for the same man any two days; for the man's mental attitude has so much effect on his feelings that his temperament is often of more importance than his physical condition. A study of the nervous system shows that fatigue is simply a nervous condition that warns a person of his approaching physical condition. Mental fatigue should never be allowed to become acute. Every man has a limit to the overload which he can carry, and once he has approached that limit and knows where it is, he should keep away from it.

Another plan, which has the advantages of a rest period and appeals better to the office force, is a general airing of the rooms accompanied by mild callisthenics. This plan is often installed, is liked by nearly every one, but soon is forgotten and dropped.

The only way it can be kept up is to order an absolutely callous janitor to go the rounds of the office at a certain hour and open every window wide and see that they are not closed for a certain length of time. Then the exercise becomes necessary as a preventive of colds.

Social Demands Affecting Hours of Labor

Every married man owes something to his family besides the cash which he brings home on pay day. If he simply treats home as a place to sleep and get two meals, he does not deserve a family. The employer who makes his hours so long as to require such a way of living is not contributing as he should to the future welfare of the nation. To be sure, there are always men who are willing to take what are practically watchman's jobs of 12 hours a day for 7 days a week. They are men who need the money and who have no trade.

Hours of labor were not reduced in many cases because men would not work longer hours. When the 8-hour day came, it amounted only to 10 hours' work with pay for 11 hours, as all time over 8 hours was to be paid for as time and a half. This bargain, of getting something for nothing, was what impressed workmen the most. Naturally, in the course of time the effect of demand and supply determines the hours of labor within the limitations of men's strength, and so as to allow the workman a reasonable time for the social side of his life. When there is a great deal of work available and the rates are necessarily high, some men will work long hours, even if it is necessary to take two jobs, one in the day time for one firm, the other at night for another; but in times of slack work the general run of employes are reconciled to dividing what work there is between the men who most need it for their families, consequently still shorter hours become inevitable. Experience shows, however, that nearly all men are more concerned about the number of days which they work each week than about the number of hours each day. If a shop must run only half time, nearly every one will agree to work only 3 days a week where no one would like to work every morning or especially every afternoon. Again, if the number of hours per day is decreased, there is almost always a movement to try to get Saturday wholly clear in order to make a longer week end.

There appears to be no very good reason why different hours should not prevail in different parts of an establishment, according to the nature of the work. In some factories where the day's work is limited by the equipment, as in the manu-

facture of rubber shoes, all the employes begin work at the same time in the morning, but they go out at various times during the afternoon as their allowance of work is completed.

In conclusion, it is safe to say that there is no great pressure from workmen themselves for a shorter day than 10 hours; that their preference is for reduction of the hours per week rather than per day, and that they would like to get Saturdays clear, if the hours are brought to 50 a week or less. Further, it seems that special hours for special work are feasible; and that the three 8-hour shifts are not desired by the workmen, for even under war stress it was very difficult to fill the 11 P. M. to 7 A. M. shift except by cleaners and repair men at exorbitant rates; and that different hours may be used for different gangs and different individuals without trouble, provided it is understood that requests for shifts from a gang working for one length of time to another gang working another will be given careful consideration.

Helping Employes in Their Homes

Frequent attempts have been made by employers to help their workmen in their homes. Such action may easily be overdone, and it has often been very badly overdone so that it resulted in harm rather than good. In its mildest and most successful form such help consists in having a follow-up man visit the homes of men who are reported as being out sick, to inquire after the patient. If this man is tactful, and if he is given to understand that his value to the company will not be rated on the number of calls he makes, he may be able to make himself a most profitable addition to the force. In some shops, names of men who are absent and reported to be ill, either by fellow workers or by their relatives or themselves, are given to the follow-up man each day and he visits them so far as possible and as soon as possible. If he drives up to the house in an expensive car with the name of the company plainly in sight, he will find out very little. If he comes on foot or in a rather dilapidated car of some make that is seen every day, he will probably get all the information that he wishes, except in those cases where a man has taken another job and sent word to the old shop that he is sick, so that he may have time to try out the new job.

The next stage in home follow-up is the employment of a visiting nurse. If this nurse goes only to homes where the follow-up man has found actual sickness, and especially if she can go with the sanction or at the request of the mutual benefit asso-

ciation, then she can do a great deal of good. There have, however, been many cases where the nurse, being a good woman or man, but unused to the conditions of workmen's lives, was so anxious to do good that she did a great deal of harm by giving unsought advice. Once the follow-up man has made a satisfactory contact, and the nurse has shown her tact by being helpful in a manner entirely professional, there is a good chance that overtures may be made by the man or his family for the advice which they would have resented if it had been offered unasked by an overzealous and officious welfare worker. The successful method seems to be almost wholly one of non-interference in private affairs, no matter what the temptation.

Education

One of the largest factors in increasing or decreasing the labor turnover is the lack of understanding that employes have of their work, of the reasons for the various steps in the manufacturing, of why so much system is necessary in a large shop, why it is impossible for an employer to pay in direct wages all the difference between the cost of material and the sale price, and, in fact, of everything that may be classed under the head of shop economics. This understanding can be obtained only by education, which must, first of all, be based on public-school education. The knowledge of a profession may be obtained in schools that are practically public; in a very few places some of the most common trades may be learned at public expense; and some shops have arrangements whereby they teach the particular trades and professions of use in their business to a selected few, in some cases by means of their own schools and in others through cooperation with public or semipublic schools. For these reasons, the public-school problem becomes a very real matter to every shop. Most shop managers, however, find it easier to complain about the product of the schools than to make constructive suggestions; but few such managers appear to have made enough progress with their own methods to justify the belief that they would handle the problem much better than is now being done.

Public Manual-Training Schools

One of the answers to employers' criticism regarding the inefficiency of the public schools is the manual-training school. It has not accomplished much, except in those places where it has fallen into the hands of men who had trade leanings. The worst faults generally found in such schools are lack of thor-

oughness and lack of practicability. Such faults are, however, to be expected. The manual training school is after all a school, not an apprentice shop. It is planned to give an education, but to direct that education along some line of industry. Owing to limited equipment in the school and to limited time, the manual training school can serve only as an introduction to some branch of industry. At the best, equipment is provided sufficient to allow only a very few hours a week of manual training, and that is divided between woodworking, cabinetmaking, pattern-making, forge work, and machine work. The schools in a great many cities of considerable size have not progressed so far as machine work.

Public Trade Schools

Another form of response to the demands of industry are the trade schools. Some of them are showing ability to turn out graduates for whom there is a place in industry. Some are merely manual-training schools with another name. There appears to be no way that an employment manager can tell whether to give any value to a diploma from one of them without personal knowledge of the school. If a trade school has sufficient equipment so that the pupils get at least 20 hours each week of shop work on real product in whatever trade they are taking up, and if the work turned out is salable, then it is likely that the graduates will make something of themselves, with a little experience under commercial conditions. They cannot do this, however, unless the instructors are men of practical knowledge. Usually such men need to be taught to teach, as it is not natural for them to analyze and transmit their thoughts. Moreover, there must be a good balance between the men who teach shop work and those who teach the academic subjects. The latter must be men with a broad tolerance of the shop, and who recognize that the teachers of shop work have a necessary place in the school; the shop men must have an equal tolerance of the academic teachers. It is not easy to get such a combination of instructors, so it is nothing surprising if the trade school does not measure up to its fullest possibilities; but, given the right faculty, and adequate equipment, the graduates should be the very best material for employment in whatever trade they may have studied in school. They have one very decided advantage over boys who have picked up a trade or served an apprenticeship, in that they have had enough academic work so that they can think their way through the jobs which come to them and do not have to depend entirely on remembering how they were told to do some rather rare job in the past.

Part-Time Schools

A combination of academic work given in the public schools or colleges and actual shop practice in commercial shops is furnished in part-time schools. The usual plan is to have the student spend alternate weeks in school and in shop; sometimes the interval is two weeks. This plan is used for both trade-school and engineering-school work. Theoretically, it is as nearly perfect as any one could wish; practically, there are the same objections to it that occur in a full-time trade school if the faculty is chosen in the same way as are the instructors in the full-day trade school.

The part-time school places the boys in the shops under the foremen of different departments in succession. Very few foremen are teachers. Moreover, they have the duty of getting out work, of making a record in production. Teaching the boys who are assigned to them is a side issue, something that most of them do not care to do, but which they take on in a perfunctory way because they are told to do it. There is very seldom any means for teaching the foremen how to teach and they would probably resent having any one try it.

The teachers in the schools are likewise selected for their academic accomplishments, rather than for their knowledge of the trades for which their pupils are being trained. There is no great opportunity for them to get acquainted with the foremen in the shops, for the foremen, being shop men, are not available for conferences and meetings as they would be in a school. There is not the opportunity for an organized course of instruction in shop work that there is in a school, as the work is necessarily a part of the shop's production and must be made up when there is a sale for it. Moreover, a trade school can secure a very much larger range of work for its pupils than even a very large shop can offer.

When this part-time plan is applied to engineering work, the conditions are somewhat different. The pupils are more mature and have a better idea of what they are attending school for. They insist on getting instruction from the foremen with whom they are placed. In fact, it is part of their training to be able to secure information. In engineering work, the college professors have more time to follow up the work their pupils do in the shop and to show its relation to their studies. The professors are, however, at a disadvantage, in that it is impossible for all the students at the same time to have work that illustrates the lectures that are being delivered at the college. When

the professor must deal with such conditions, about all that he can do is to strike an average, arrange a course of lectures and make them as clear as possible without the practical illustrations that would be furnished in the shops of an engineering school which had complete equipment.

If the employment manager finds himself in a shop that is cooperating with some school, either as a part of trade training or as a part of a college plan, he can make the routing of students through the shops correspond as nearly as possible with something that the instructor in charge of academic work can follow in the class room and lecture hall. This, however, is not easy to do. For example, it is usually impractical to arrange for all the students to have their practice in the boiler and engine room at the time when the subject of thermodynamics is being studied.

Continuation Schools

Because a great many boys leave school as soon as the local laws permit them to be accepted in a shop, several states provide by law for continuation schools for working men and boys. In these schools at various times through the week, classes are held to which boys who are working are sent to pick up their general education at the same time they are earning a living. Some of these classes are held early in the morning before boys who work in offices have to report, others are held at night after work, some on Saturday afternoon, and many others during working hours; for in some states the law requires the employers to allow a certain number of hours weekly to attend these schools without deduction from their pay. Such work is not industrial education, but is strictly general education that these boys would be unable to get otherwise, owing to the fact that they are working.

Unfortunately, few of the boys who are affected by these laws have any personal interest in this educational work. Most of them left school to go to work, to be sure, but it was because they thought that the shop was the lesser of two evils. When they are allowed to go to school during shop hours, they look on it as a lark and absorb very little information unless they fall into the hands of an instructor who makes the lessons very interesting, not to say entertaining.

In some instances this work has been much improved by giving the boys work drawn largely from the trades at which they are working. This makes concrete problems possible, which in itself is a great advantage, both in its educational effect

and in its drawing power. If classes are made voluntary, a few boys will attend so long as they can see, with their limited vision, that they are getting something; when attendance at the classes is made compulsory the lessons are either treated as a joke or are gone through in a sullen half-hearted way.

Corporation Schools

The term *corporation schools* includes the various kinds of educational work carried on by corporations and other business firms. It includes what are practically continuation schools conducted by the firm, apprenticeship systems, trade schools within the works, but entirely separate from the production department, schools for salesmen and minor executives, and any other educational activities into which the firm may care to go.

The first efforts of a firm that foresees a shortage of skilled men are usually directed toward an apprenticeship system, regardless of the fact that real apprenticeship has been practically dead for years. To make this new apprenticeship attractive, and also because there is a realization that some rather technical knowledge is desirable even in a workman, classes are formed for instruction in what may be classed as mechanical intelligence. Usually an attempt is made to hold these classes in the evening outside of working hours. This does not work; as the apprentices feel that they should be paid for the time spent, and if that is granted they soon want time and a half for this overtime. Then the class-room work is put into the regular working day.

The next development is brought about by the reluctance with which foremen take boys into their rooms in the regular course of business, knowing that at the discretion of the supervisor of apprentices the boys will be taken out soon and moved elsewhere. As a result of this difficulty, it is discovered that no more machinery will be tied up by having all the apprentices in one place than if they were scattered over the shop. Then some one foreman is discovered who is interested in boys and who has the patience and the teaching knack to handle them. Thus the shop has a complete trade school of its own. This last stage is the most successful and the most lasting of all.

When the boys are scattered over the shop, there is need of some pretty close supervision of the shop work by some one man. Without such supervision, it will soon be found that the teachable boys are persuaded to leave the class and stay with one of the first foremen they meet, while the laggards are passed from place to place quickly, learning but little, until they are finally pushed out the door without having had a real chance

to learn anything. This defeats the real purpose of the apprenticeship school, which is to train a group of boys into all-around men who will aspire to good positions with the company.

When the apprentice school becomes a complete trade school, it encounters all the problems of the public trade school, with the two exceptions that it can make a more favorable selection of pupils and that its work and problems may be entirely taken from actual industrial life. Both of these are very much in its favor, so much so that it would seem that in moderate-size communities business men could get together and run a joint trade school, and train their boys on a wholesale basis to considerable advantage. However, from the point of view of the public, it seems no more than right that any boy who aspires to become a patternmaker or a machinist should have the same opportunity as does his brother who aspires to become a lawyer or an engineer. On this plea, each community should in fairness offer trade training; but, even if it does, there is nothing to prevent any manufacturer from starting his own school unless he feels that he ought to stand by the town and give it his support. If the community does not see fit to offer such a training, there is no doubt that shops will have to, as the supply of skilled men is now somewhat curtailed both by embargoes in foreign countries and immigration laws here.

Organization of an Apprentice Trade School

Equipment for an apprentice trade school is usually gathered from the shop. Foremen will, of course, try to get rid of the worst they have, as anything is supposed to be good enough for an apprentice, but the supervisor should see that he accepts nothing the design of which is much behind the average of the shop. Broken parts and worn parts need not affect him, as they offer the finest possible thing for boys to work on. He should look at every bit of equipment as something that is to be brought into perfect condition and kept there. His greatest trouble will be to get instructors. A good instructor is also usually a good foreman, though the reverse is not necessarily true. Because he is a good foreman, the production department wants to keep him, and they will generally do so until the management is sufficiently impressed with the necessity of supporting the school to insist on his transfer to it. A school that is simply a fad with some one in the management, and which he is allowed by the rest of the company to play with, is hardly likely to be very successful. It needs the full support and backing of the whole board of directors to make it a success.

Certain things should be conceded in advance of any training; one, that the first comers in the school, the apprentices, will not do so well in a given length of time as those who come later. This is not altogether because the school is new, but because the example of the older boys is not there to encourage the younger. Another thing is that a great deal of time will be spent without apparent progress, just as in the spring the seed lies in the ground with no visible signs of life. Again, discipline will be more difficult to maintain, the percentage of spoiled work will be comparatively high, and the rate of production will be low.

The primary object of a trade school, whether public or in a shop, should be to teach boys to think straight, and especially to think straight about mechanical things. If a man can think in thousandths of an inch, he can make his hands work to that fraction; and, conversely, a man who can work so accurately is likely to think of other than mechanical things with the same accuracy. The greatest criticism made of our skilled mechanics and engineers is that they are so accustomed to working and speaking in terms of minute accuracy that it is almost impossible for them to tolerate the rest of the world. However, a little accurate thinking is a good example for all the rest of the citizens of any community.

Work in a Shop School

The work that the apprentices are to do should nearly always be drawn from the work of the shop itself. If the school is for the training of machinists, as are more than half of all such schools, the work should be mostly on stock parts, such as may be made on a regular shop order, but which when completed will be put in the stock room to be drawn on from time to time as required. Very little work that must be completed at any given date should be undertaken by beginners. Moreover, there should be a large amount of work in process compared with the amount that is being completed. There is nothing that helps good instruction so much as to have a large number of jobs of different kinds from which to draw the next job. For example, a boy may be on his first job of threading on a lathe; if he takes hold of the job extremely well the instructor may next give him a job on which a small amount of other work has been done, though this will be lost if the boy spoils the thread. If, however, a boy on his first job of threading does not get on well, the instructor will probably find it safer to give him some bolts to thread that would naturally be cut on the bolt cutter. Similar conditions apply to work on a planer. A boy

may have some parallel strips to plane; if he shows intelligence about getting them out of wind, the instructor will want to give him for the next job, possibly some flat plates with the edges to be squared. If, however, the boy does not do well with the strips, the instructor may want to give him as a job something that needs nothing but a roughing cut to be useful, but which may be smoothed up, if the boy shows ability to do it. Just so, through all the trades that can be handled in a trade school, a large number of jobs on hand enables each boy to progress so smoothly and readily that he will hardly know that he is being taught at all, but will think he does it all himself.

In general, the work of the individual boy may begin on any machine that is in common use, even on a grinding machine. The idea that all boys should begin on an upright drill, and progress through lathe work to milling and then to planing, has been proved to be without foundation. Each of these machines has functions in common with all the others, and other functions that are entirely different. The assumption that planer work is the hardest to teach is not borne out by experience. Some adaptability is required to do planer work in a shop where there are no special holders for the work, but the same is true of face-plate work on the lathe, and milling work that has no fixture designed for it.

The Work of an Instructor

At the very beginning, it appears best for the instructor to set up the machines and start the boys on the work, so that all they really do is to start and stop the machine. If there is an automatic stop to the feed, it should be discarded just as soon as the boys have become familiar enough with it so that they are not afraid of the work and will not get disconcerted.

If the boys are to learn to think, however, it will not do for the instructor to do their work for them beyond this time while they are learning the ways of the shop and getting over their fear of machinery. If the instructor carries them too long, they easily become conceited and think they have done the whole job themselves; but if they really have to do it themselves, they will acquire a respect for the skill of men who can do easily the things that give them serious difficulty.

It will soon be found by the instructor who analyzes his jobs that the real difficulty for his students lies almost always in the making of measurements. In this respect almost all trades, with the possible exception of the printers and paperhangers, are alike. If a boy can measure with certainty to a quarter-thou-

sandth of an inch, he can usually work at least as close. Therefore time is well spent in discovering how well a boy can measure and in teaching him to do it correctly, even if it requires the spending of considerable time in non-productive practice. When a boy once gets so that he can take a micrometer, bring the screw up to the anvil once, feel how hard he turns it to come to the zero line, and then can measure a piece of work with certainty that he exerts the same pressure, he can go on with the same certainty, unless something happens that seriously disturbs his confidence. For this reason, a scolding is quite likely to do more harm than good. Self-confidence without overconceit is what is needed. It is hard for a man who is in constant fear that his micrometer is not set right to get out any reasonable quantity of work; he is always fiddling over the instrument and constantly running it up to zero to get the feel over again, when he should be turning out work.

After some boys have been in the school two or three years, and the younger boys see what they are accomplishing, it is easy to get the new boys to go ahead rapidly. In the early stages of the school, they see only the work done by journeymen, and they do not deem it possible that they will ever be able to do it, in which idea they are, more often than not, encouraged by these same journeymen; whereas boys do get to be very expert, especially in the absence of the older men who are constantly reminding them of the dangers of overwork. Experience with trade-school boys shows that there is more danger that they will have to slow down from their school pace to meet that of the shops than that they will have to speed up. This is true if the work is done on a day basis or on the basis of piece work with a limited production, which amounts to the same thing. Trade-school graduates, however, find it comparatively easy to rise to the emergency when they find a piece-work system where rates are not cut, or where there is a bonus system that puts a premium instead of a penalty on high production. Understanding fundamental principles, they find easy ways of accomplishing difficult things.

Academic Work

Many competent shop managers object to the word "academic." The boys in the trade school need to be able to read readily, to write legibly, and, without serious effort, to use arithmetic through square root, to know the fundamental principles of geometry, and to be able to handle enough trigonometry so that a table of the natural functions of angles is a useful tool.

It is possible to have the boys read trade papers, write shop reports, and do shop arithmetic, and thus cover the academic and cultural side of the instruction.

Two branches may be especially emphasized in the training: physical science and shop intelligence. Physics, for the machinist trade, should lay stress on mechanics; for some other trades, on chemistry, as in the manufacture of paints, dyes, etc.; on sound, for the manufacture of pianos and organs; on light, for the manufacture of lighting apparatus; on heat, for manufacturer of stokers, engines, pumps, and so on. Here again the usual textbook on physics is not exactly what is required, if for no other reason than because it is usually written with reference to the metric and centigrade system of units, while in almost every case the results of study of books must be used in terms of English units. Moreover, the problems usually given are so abstract and so lacking in application to the practical problems met in the shop, that it seems almost necessary for each school to prepare its own books, though an exception may occur in the machinist business.

The greatest difficulty usually experienced in shop trade-school work is to get an adequate amount of time for the academic work. If one-sixth of the week is given to it and half of that is available after the necessary drawing is taught, the instructor is fortunate; whereas, in the public trade schools the pressure is in the opposite direction, and the time for academic work is likely to be even more than half the total. However, in such instances the time spent on these subjects is by no means wasted, if the work is given a real shop flavor; for the boys who have a clear understanding of mathematics, and especially of physics, will surely outstrip the boys who have learned *how* to do things without also learning *why*.

This matter of the amount of instruction that is to be given in the academic subjects should certainly be considered and decided by the highest power that it is possible to reach in the organization, for its bearing on the future of the establishment is of the greatest importance. If the organization is of the one-man type, then it is probable that very little time will be allowed for "book learning," and the instructor will probably have to give that little time while the boys are leaning over a drawing board or by cajoling them into studying at home. If the shop runs more to organization and democracy, then there is much more likelihood that the appeal for teaching the boys *why* will be successful.

If time cannot be obtained for teaching physics, it may

possibly be obtained for the teaching of shop, or mechanical, intelligence. This can be launched by getting experienced men to give talks on some of the mechanical mistakes they have seen. Such talks will lead naturally to instruction in mechanical principles sufficient to prevent the making of similar errors, and this instruction may be extended to a full course in mechanics, from that to a well-proportioned course in elementary physics, and from that to mathematics.

Training of Foremen

The training of foremen may be of two main types. Young men who show evidences of executive ability may be trained to fit them to handle the work in some department; again, men who are already foremen may be trained in the newer ways of handling help, and in their relations to the organization. This latter kind of training is perhaps more necessary with the change from a strictly line organization to staff and line or to a functionalized organization.

For the first-mentioned kind of training, the men selected to be trained are assigned successively to each of several departments, the work of which has a close relation to the department in which it is hoped that the man may become a foreman. In each of these he stays long enough to do all the important kinds of work well enough so that he can appreciate the difficulties and troubles that naturally arise, and also so that he can see just what he can rightfully expect from the departments that precede his in the manufacturing process, and what he should be able to deliver to those that follow. If the work involves mathematics, mechanics, etc., he should also be instructed in such of these things as are necessary to supplement his past education, or to refresh his memory. The latter is the more tactful way in which to present the subject to a foreman, and it is true that it is nearly as much of an effort to straighten out the men who have had a good education and not used it as it is to teach the subjects completely to others who have not had any part of a technical education.

The large problem with both classes of trainees is to teach them the new order of things in their relations to the firm and to the men under them. This new order has its largest apparent difference from the old in the matter of discharging or dropping of men. Under the old order, which prevailed at almost all times from the first years after the Civil War up to the opening of the World War, men who wanted jobs were so plentiful that the foreman could discharge a few at any time, for the

sake of the example on the rest of the men or for the sake of displaying his authority, with the full knowledge that he could have the choice from a large number of others to fill the vacancies which they left. Until recently, no one took the cost of training new men seriously, and the losses from such random and arbitrary action were not apparent. Later it became well understood that unnecessary loss of men might cost hundreds of dollars each, and that, in the case of semiskilled men, it amounted to at least $50 each. Such losses, multiplied by the number of men lost, amounted to large sums.

The purpose for which the training classes for foremen are largely maintained is to help each foreman to find a way to maintain discipline and secure production without resorting to the hiring and firing methods. This requires a full, frank, and free discussion of all the things that have been discussed in this section in relation to the reasons why men leave the shop. The foremen should have each week's report of men leaving classified by departments and also classified according to the reason for leaving. They should compute, as nearly as they can agree, what it will cost to replace the men that have left each department in a given week, and consider just what steps might have been taken to avoid the loss, what is the best method of replacing these men. Of course, if the work is done by skilled workmen, and there is a plentiful supply, so that better men can be obtained than those who have left, the cost of making the change becomes negative, and the foreman who is far-sighted enough to fill up his department with men who will make a good nucleus around which to build a large organization when business becomes better should be commended.

The first thing that a foreman has to do after he has accepted a man sent him by the employment department is to find out just what the man can do, both as to quantity and quality. A foreman who puts a man on an easy job when he might be doing better work, is throwing away money for the company. Some men will insist on getting as good work as they can do, or sometimes better than they can do successfully. The foreman's instruction should bear on this point, so as to make plain that the firm cannot afford to have any work done by a man who can do better work, except in an emergency.

Another thing that may well be presented to a class of foremen is the quality of patience with learners. When a man is hired with the understanding that he is a learner, full opportunity should be given to him to learn. If he is quick the foreman should watch him closely to see that he is thorough, but

if he is slow he should be brought along without being too much hurried. There are many cases of men who have been slow to learn but who have later on filled positions of importance. They have usually done it by being buffeted from shop to shop, but in each shop they have picked up a little, and by putting these many littles together they have ultimately outstripped the brighter men. It is the old story of the hare and the tortoise, and it is repeated day after day. If the management of any shop that has been in existence for 20 or 30 years looks back over the records and lists the men who have worked for them they will almost certaintly discover that they have lost enough men who have since made good to have given them an organization that would be far better than the one they have. If such a record can be spread before the foremen it will be an object lesson that will do more good than all the lectures that the general manager can deliver to them.

The Foreman as a Teacher

One of the most important jobs of a foreman is that of being a teacher or instructor. In a few favored shops, the management will install a school for the training of certain apprentices in skilled work; sometimes there may be a vestibule school, or trade school teaching certain workmen each a single operation. In spite of all these efforts, the majority of all workmen still go direct from the employment office to the foreman, and they succeed or fail according as the foreman's ability as a teacher.

In many instances foremen have discharged men for not knowing how to do a job, when the fault was the foreman's because he had not told the man how in an intelligent manner. Foreigners will almost always say "Yes, yes" to any instructions; not meaning that they understand, but as showing approval of the foreman and a desire to please him. Then they watch some one else and do what the other person does as nearly as they see it. It is not enough to tell a man how. He must be watched until it is seen that he has grasped the idea.

The first principle of all teaching is to analyze into its elements the thing to be taught; and it is just there that the first attempts at teaching often fail. Very few practical men analyze their own jobs. They have done the work so long that it is second nature for them to do it correctly. They do not realize half what they are doing while they are doing it. They are like jumpers or golf players, who cannot tell what motions they make until they see them revealed by a slowly shown moving picture, and then they can hardly believe what they see. There-

fore, there is need of analysis of the job down to its minutest elements. This analysis often shows the man who is accustomed to doing the work how to do it in a better way, and that is a valuable thing for him to discover.

Then, there is the necessity of stating simply and correctly what is to be done. The instructor who fails for words and tells a workman to "take that d—d thing and move it up about a foot and then tighten up those do-dads on the back," may have a very definite idea of what he wants done, but he does not convey it. Exactness of instruction can readily be obtained as soon as the instructor knows definitely, by analysis of the job, just what he is trying to teach. Foremen can often teach best by showing how an operation is performed and explaining the relation of one part of it to another. Many workmen, especially the uneducated can not visualize from oral instructions.

MISCELLANEOUS FACTORS IN PRODUCTION

Safety Engineering

The department having to do with safety is usually related to or a part of the employe-relations department. It, however, has to deal very directly with the production department, and also with the company that carries the insurance, unless the shop carries its own insurance. The safety department is customarily looked on, not as an aid to production, but as a hindrance to it. The members of the department may be tolerated for their good-fellowship, but not often for their work. Although entirely natural, this is an altogether wrong attitude for the production department to take. A good safety department, introduced in almost any plant, will for a time seem to make production more difficult or at least slower. In the long run, however, it will aid production, because a safe shop attracts the best class of help, and this good class can and will turn out enough more work to offset entirely the little slowing down that may result from the activities of the safety department.

Haste and Accidents

Daily experience shows that most accidents come from too great haste. We do not look to see whether an engine is coming, or if we see it coming we take a chance and speed in front of it. It is characteristic of Americans, whether born here or newly adopted, to take these chances merely to save a few minutes of time. Often the demand of the shops for punctuality is a cause of accidents.

The most effective way to prevent accidents is to remove the chances for them to occur. The removal of incentives for haste and carelessness will do little good. Carelessness is too strongly ingrained in many workmen. Therefore, instead of depending solely on the success of efforts to teach workmen to be more careful, these efforts should be supplemented by safeguards against injury even in moments of thoughtlessness. Unfortunately, these safeguards may hinder production to some extent. However, the demand for safe working conditions is constantly growing and will doubtless increase.

The Safety Engineer

As a result of the growing appreciation of the importance of safety a safety engineer has a much greater hope of accomplishing results than he had a few years ago; but he cannot hope to accomplish much unless he is really an engineer and can so plan his safeguards that they interfere as little as possible with production. It is sometimes asked, why, with all the state inspections and inspections by the employer's liability insurance carrier, there is need of a safety department for a shop. The need, theoretically, should not be there; but the inspections by the State are usually only to discover whether the technicalities of the law are observed. The inspectors are not usually men of any great insight into the business they inspect; consequently, they make many recommendations that need to be reviewed and possibly reversed. No one is in a better position to do this than the plant safety man. Then, the fact that the State inspector is allowed to report only on things covered by the law makes his work particularly ineffective, because these laws are necessarily general and may not apply well to the conditions of the particular shop.

The insurance inspector likewise sees things from his side only. Almost every report made by an insurance inspector has suggestions that are really unreasonable in view of the surrounding circumstances. Full compliance with his suggestions would seriously cut down production. The safety engineer is the man to take into consideration all the facts and recommendations and to agree upon measures that will produce the required results, but which will not cost a prohibitive amount either in first cost or in lessened production.

The safety man also has a great opportunity to assist and back up the employment department in producing good feeling among the employes. There is no time when a little human sympathy, rightly directed, goes further than when a man has

been injured and is getting ready to get back into the shop. The man who holds out a practical helping hand to him then is likely to be his friend forever. If the safety engineer can arrange to make the payments for compensation directly to the man, having first cashed the insurance company's check or even having the firm advance the money so that the payments may be more prompt, he can make up for a great deal of the loss in production due to the accident, through improved morale. Most workmen are very "good sports," in that they accept accidents as a part of their vocation; but they think very highly of the man or the department that makes a visible attempt to make accidents less likely to happen and takes care of the victim after an accident has occurred.

Work of Safety Department

The work of the safety department may be classified in three parts: (1) The guards to prevent the possibility of accidents; (2) safety practices in production; and (3) the care of men who are the victims of such accidents as do occur.

Guards may be placed in accordance with good engineering and established safety practice on the advice of an expert, or they may be installed as a result of experience, on the same principle as the farmer who locks his barn door after the horse is stolen. Safety practices in production do not very often seem to come except as the results of accidents. If a tabulation of all the accidents that have cost the company anything in lost time or hospital care, or that have made payments by the insurance carrier necessary, is presented to the management at the end of each year, it may be possible to so analyze them so that the management will see the profits in dollars and cents of discovering safe methods of doing work. For example, men wheeling barrows of heavy material up an incline may rush across a passageway at the foot of the incline so as to endanger the safety of persons passing. It is for the management to say how this danger shall be avoided, but whatever the decision as to the right of way, the passage should be so guarded that nothing is left to chance.

Housing as Related to Production

Nearly all housing plans in connection with factories have been evolved as matters of necessity. There is a great difference, in methods as well as motives, between the operations of a contractor opening up a real estate development and a company furnishing housing for its employes. The contractor is

looking for an immediate profit; the company's housing operation is usually regarded as an expense that may or may not result eventually in a profit.

The builder for profit leaves a great deal for the purchaser to hope for and ultimately to do for himself. He will try to sell his houses before they are papered or the electric light fixtures are in, on the ground that the purchaser will prefer to select such things to his own taste. The lawn will often be left to be graded and seeded. Shrubbery and trees also are omitted. The sidewalk in front of the house may be left undone, though front and back walks are usually put in, to avoid muddying up the house when showing it to customers.

The manufacturer who builds a model village builds what he calls a house, which is not very much better than the house built to sell, but he completes it. He has a natural pride in the completeness of the village, he knows that he will have visitors from all over the country to see it, and he wants to make a good appearance. The opposite extreme is reached in mill towns away from regular lines of travel and to which customers of the plant never come. In these towns, the houses are seldom sold to the employes, and would not likely be bought by them if they were offered. They are built with four or more tenements to a building, and each tenement has a very small back yard, hardly large enough for a garden, and a tiny front yard. Between these two extremes, there lies a sensible and feasible housing plan, one which takes into consideration the fact that a house is primarily for the comfort of the occupants, and that it does not have to be ugly to be economical.

Planning Workmen's Houses

The first requirement for determining the kind of houses that should be built is a study of the people to be accommodated and the kind of places which they already occupy. Almost every shop in the country that is outside the principal centers of population has gradations of employes, ranging from laborers whose families have been here so short a time that any habitation that has not been condemned by the board of health appears a palace, to the office people who will delight in the toy-like villages that appeal to a landscape architect. The larger number, however, will want a house that can be rented by the month for a little less than their weekly income, and one that will have rooms enough for a family. The more skilled the employes are, the greater is the likelihood that they will want single or detached houses. A complete housing plan will com-

prise a little village a short distance away from the other houses and out of direct sight of the shops, then a settlement of houses ranging from single houses to groups of six or eight in a block, together with a semi-public house in which single men may rent individual rooms. Possibly such a house may be needed for single women also. For the benefit of the morale of the shops, bunk houses should be avoided. These places, where sometimes a hundred or more men congregate, are sources of danger; one disgruntled man can produce a great deal of dissatisfaction. When men scatter to their homes after leaving their work, they find new surroundings and comforts, so that they are likely to forget some of the things that have happened through the day. Men in the bunk house enlarge upon their shop difficulties.

The size of houses to be offered depends on the size of the families to be housed. In many ways it is well to encourage a family in taking a house with one or two rooms more than they need at the time, not merely to provide for possible increases in the family, but so that the family earnings may be increased by taking one or more roomers. This also helps to avoid the bunk house problem. Generally the smallest single house advisable is one with a living room and kitchen and possibly a dining room on the ground floor and four chambers on the second floor. This will accommodate a family of father and mother and four children, and possibly a roomer. If the family is smaller than five, there may be two rooms to rent.

So far as the outside of the houses is concerned, the company should see that they are kept painted neatly, and that the fences, if there are any, are kept repaired. Among the office people and the highest grades of shop workers, small prizes for the best-kept lawns will bring large results. Among the class that prefers houses all in one block, it will likely pay very well for the company to take care of the lawns and see that they look well so as to furnish an example to others. However, it is not to be expected that people who have never lived in clean houses with clean and attractive surroundings will change their habits at once; if they are not accustomed to these attractive surroundings they probably will not want them and certainly will not voluntarily do any work toward getting them.

Gardens

For many years, some companies have furnished land for gardens, which the employes have worked, not altogether for profit, but because every shop has some men who enjoy working the soil just as other men enjoy playing golf. From a

strictly economic point of view, it is doubtful whether small amateur gardens cultivated by men who work 8 or 10 hours per day in the shop are profitable. Occasionally a man who ought to be a market gardener, but who prefers to work in a shop, will show remarkable results; but for the most part the amateur gardeners would make a great deal more money if they could secure the opportunity to work overtime, even without the bonus, than they can make in the same number of hours in a garden. There is, however, something very restful about hard work which employs another set of muscles; there is also something very pleasurable about working in the soil, and then there is the satisfaction of eating garden vegetables when they are fresh from the ground. It is not profitable for a shop employe to raise his winter supply of potatoes, if he can use his time in shop work; for the farmer who plants, cultivates, and sprays by horse or tractor power can cultivate up to 15 acres of land per employe, while the man who raises potatoes by hand finds a quarter-acre a large burden. As a general thing, gardens much larger than an eighth of an acre are not carried through successfully. A great many men will have the feeling in the spring that they can take more than this allotment; but they will give it up when July and weeds come. It is wise to tell such men to take a small plot and prove that they can handle that well, and then take two of them the next year.

It is usual for the firm to furnish the land rent free, and sometimes to plow and harrow or even to put in the fertilizer. Just how much they should do is difficult to determine. If the land is farm land there is no doubt but the work done by the employes is likely to increase its value, while if it is merely city lots that are being held for a better market, or land being held on which to build a larger shop, no financial gain is to be expected.

As a general thing, it is best to let the establishing of these gardens, together with most of the other more purely welfare work, spring from the employes themselves, and let the work be kept as far as possible in their hands. Those who really want gardens will influence others to start them and keep up those which they start better than any representative of the management can do it. Then, too, a poorly kept garden among a lot of nice ones is very plain to be seen, and the man's own pride will keep him at work at it until by and by he will develop enough love for the work so that he does it of his own accord. Probably the very best thing is to leave it in the hands of the employes themselves with a little encouragement in the way of prizes for

the best gardens, and the best exhibits of various fruits and vegetables from the gardens.

Commissary Department

Many shops offer noonday meals "at cost," which usually means at a substantial loss. The reason for doing this is closely connected with labor turnover. Unless the employes live within a half mile of their work they prefer to eat their lunch at the plant. They do not like to carry a dinner pail, nor do their wives like to get up early enough in the morning to put up a lunch as well as get breakfast for them. The consequence is that men will patronize whatever restaurants may be in the neighborhood, even though they may be dirty and the food unpalatable. When employes eat in this way, their afternoon work suffers. They are likely to be logy for the first two hours and get tired and have "that empty feeling" the last two.

Restaurants

The restaurant run for profit and in ignorance of the needs of workmen, will always offer stews that are heavy and greasy. They are cheap, because they can be made from meat that cannot be used for any other purpose. Then there will be pies made with synthetic filling, and ice cream based on cottonseed oil products. With restaurants run in this way a profit is always possible. No manufacturer, however, can afford to have his workmen eat such meals. Cold lunches brought from home would be much better for them; but if they will not bring them, then a restaurant is needed. A company restaurant will be bitterly criticised if it offers meals as poor as those furnished by the usual commercial restaurants.

The question immediately arises as to just how much the shop should contribute toward such a restaurant. Most shops allow free rent, light, heat, and in some cases the product of gardens run by the shop. Even with these allowances, it is seldom that the restaurant pays its expense, largely because it does not charge commercial rates for the food. These rates have to be set with due regard to dinner-pail costs and cheap-restaurant costs. The dinner-pail cost is mostly in feeling on the part of the wife; boarding houses will seldom furnish a box lunch to take to the shop. Around some shops there will be found men with the enterprise to put up box lunches and sell them at the gate, and some of these furnish really excellent food. They can do this, because their overhead charges are entirely negligible. The cheap restaurants have to pay rent, except in case of a

lunch cart; they also have to pay for heat, light, and so on; but, as already stated, they do not have to buy as high quality foods as the shop will feel obliged to furnish.

Whatever apparent loss there may be in the restaurant, however, can be most certainly made up in the production department, if foods of a good quality only are sold. Greasy foods should of all things be avoided. Half-done soggy potatoes should be barred out, and none offered unless they are well done and mealy. Baked potatoes are good, but if offered the same day with mashed potatoes will not be eaten. Stews are all right in cold weather, if made of sound meat, the grease skimmed off, and crackers offered instead of dumplings, as the latter are usually heavy and indigestible. Desserts may consist of real pies; that is, pies made from apples, lemons, mince meat, and so on, and not the canned material which is so much cheaper. Real ice cream, and puddings made from stale bread, tapioca, etc., will sell well, especially with whipped cream, and they are easily digested.

A compromise with the full, or complete, restaurant has been made by some shops with good success. By this arrangement the men bring with them sandwiches and possibly cake if they wish it, and supplement them with coffee and desserts at a lunch counter. This works very well, especially if in winter a good thick stew is furnished, in which case many workmen will not bring anything from home, but will make a meal out of the stew and desserts.

Cooperative or Company Stores

Another branch of commissary work is the cooperative or company store. During the periods of high prices of foodstuffs, it has been common to find groups of men combining by subscription to buy foodstuffs in large quantities, and distribute them among themselves. In some instances, the shops have carried this a step further, and have used their credit and purchasing department to make purchases without knowing who would buy, and then opened a store for their distribution to their employes only. This always arouses a protest from the storekeepers of the neighborhood. Consequently it should be done only when the storekeepers are not doing all that they should to give service at a reasonable profit. The gain to employes is not a very large one as compared with their total expenses. If the grocers and other tradesmen of the town are unreasonable and if the employes live in a fairly compact group, the plan will probably be successful. It may, however, be met

by a "cash and carry" plan on the part of the stores, which is quite as advantageous to the workmen. In any event, it is not wise for a shop to establish a delivery system unless for flour in barrels or potatoes by the bushel or some such rather large orders that cannot be carried home by the men. Credit plans in shops are always provocative of disputes as to amount owed, and while the shop has the whip hand, it is all the more dangerous to demand exact payment of debts.

Recreation

Under the head of recreation comes that part of welfare work which has to do with games and sports, dances, hikes, singing, orchestras and bands, and any similar activities that are partly spontaneous and partly the result of organization. There are certain quite definite advantages in having such activities centered around the shop, and yet there are serious dangers if the company takes too free a hand in them, or if it lets them run with too loose a hand.

For example, under good conditions there is no better recreation than dancing. But dancing is likely to reflect the actual character of the dancers, and as the evening advances the restraint imposed by social usages is apt to break. If dances are conducted in the name of the company, it is perfectly legitimate to insist that they be chaperoned by people, responsible to the company; the effects of a badly conducted dance may injure a firm by driving away just the class of workmen most necessary to the firm's prosperity. If, on the other hand, the company conducts dances under its own management, something may happen for which the company has no moral responsibility but which will be held up against it by its own employes.

Sports and other social activities help to keep down the labor turnover and also to attract a great many desirable employes. The great majority of workmen have some finer sense which makes them prefer to work where the shop is clean in all ways, and yet they all want to work where things are "alive." Not all of them will agree as to what activities they are most interested in. Some care only for dances, some want to be amused and will go to see film comedies, but will take no active part in amusing themselves or others. Some require the most strenuous possible exercise, as rowing and other athletics, while others wish quieter games and will make up a whist club in the winter. All of these things are good, but they depend for their success, as a shop affair, on the opportunities for their exercise on a purely voluntary basis. If there is a reasonably level

ball field near the shop, there will be a ball team whether the management knows it or not, and it will surely play games under the company name. If there is a good river for rowing close by, there will be boat racing, if only in flat-bottomed rowboats and canoes. If, on the other hand, the facilities for any sport are at a distance, there is little likelihood that much will come of it, even with all the encouragement that the company can bring to bear. The artificially stimulated sport does not persist after the stimulation is removed.

All of these forms of recreation, if natural and only slightly controlled by the management, are more than likely to help keep down the labor turnover and raise the morale of the place; but the slightest hint that the management or any of the foremen are trying to exploit the workmen is instantly resented. If men who are known to be capable oarsmen do not wish to row are compelled to give up time they would prefer to put into gardens, rather than lose their jobs, then the whole thing becomes an advertising scheme on the part of the employers, and its good effect is annulled.

Employment of Cripples and Mental Defectives

When a man is injured in the shop, it is customary to give him some easy work around the shop in order to get him back on the pay roll as soon as possible and off the insurance carrier. He may carry messages or run an elevator. As soon as it is demonstrated that he has recovered and is back at work, the feeling of responsibility for him is likely to fade away. There is very little effort to discover ways in which he can become as useful to himself as he was before, whereas he should be made so much more capable of earning money as to make up his financial loss. A broken leg may hinder a man's activities for the rest of his life; but often a man so handicapped can be trained in a way that may make him more efficient than before. Men who acquire tuberculosis through long exposure to wet and then to dusty conditions needs special care to arrest the disease and make a recovery possible, and they further require the kind of work that they can safely do. There is a similar need in all cases of sickness or accident arising out of employment. Concerted action toward such rehabilitation work is slow in coming about. Most of the efforts to promote such action have been made by engineers in charge of accident prevention. Usually the most effective work in training and placing crippled men can be done through joint action of the safety

engineering department and the education department of the individual plants.

Mental cripples have always been present in shops, and probably always will be. They range all through the milder forms, and, unfortunately, they usually grow worse and worse until they finally drop out altogether, for the ordinary shop atmosphere is not conducive to mental betterment. In attempting to place such mental cripples, great care should be used to distinguish between men who are only mentally underdeveloped, those who are suffering from nervous troubles, and those who are mentally diseased, though these conditions run into one another and overlap so much that one man may have all three troubles. However, the fact that a man's intelligence rates up only to that of a child of 12 years does not indicate mental disease any more than the fact that a man is only 5 feet high indicates that he is physically unsound.

The Binet tests or some of their modifications indicate the mental age of the workman, and tell what may reasonably be expected of him. A low mental age does not imply any handicap, except that the person so rated cannot be expected to think clearly or rapidly. A man of very low mental age and good physical development can do a great many things, if he is patiently taught to *do* them and is not burdened with the *reason why*. The method of teaching him is just the reverse of the normal method of teaching.

The man who shows nervousness and excessive irritability may also have a low mental grade, but that is not likely unless he has suffered from neurasthenia so long that his mind has begun to give way under the strain. Such men usually show loss of weight and some trembling of the extended hands and fingers, they may not be able to stand still without their eyes open, but may topple over. Such men need relief from all responsibility and trouble and worry, and above all from fear. This last is the most important and the hardest to overcome, for the fear is likely to be fear of poverty. Once they realize their condition, there is the apprehension that their money may not hold out until they recover, and that fear only increases the length of time needed to remedy their trouble. No such case should be allowed to develop in a shop or office. There should be some way of getting men who are becoming nervous wrecks to confide their troubles to some one who can at least give good advice.

AMERICANIZATION

Why Americanization is Necessary

The United States of America, in almost all its parts, was originally an asylum for men and women who wanted liberty. Most of them were suspicious of others who wanted any different kind of liberty, and most suspicious of the natives of the country. The process of extermination of the Indians brought the colonies into closer touch than previously, and when they united in common cause against England they became still more closely knit together. Even at that time there was a considerable variety of race. The New England states had their Puritan types which could not even tolerate each other, as witness Roger Williams driven from Massachusetts to Providence. Next came the Dutch of New York, complacent, contented, and lazy, but wily; then, beyond them, the Quakers, with a sprinkling of so-called Pennsylvania Dutch who were quite different in their characteristics from the people of New Amsterdam. Then, beyond them were settlements of English again, but of a different type from those of New England. Seemingly, the only thing that could unite such a varied people was a common enemy. For many years, all of settled America was a farming country. All manufacturing, beyond the product of the blacksmith, was done in the homes. Every home had its spinning wheel and loom. Every farmer could make his own shoes, or rather boots. Ready-made clothes and hats were unknown. Moreover, transportation was so slow and difficult that there was but little circulation of the population. Men came to this country, settled in a farming country, and stayed there for a lifetime. When the new settlers came they immediately went to the country regions because there was nothing for them to do in the cities. Living, as they did, in an environment entirely new and strange to them and confronted with problems that taxed their ingenuity to the utmost to preserve their own existence, there were gradually developed customs, manners, ideas, community interests, and later a national spirit commonly called American.

While many of their old-world characteristics were therefore soon discarded, some of them were retained for several generations. This is especially true of the arrivals that have remained in groups, as in our larger cities and in some of our smaller communities, each settled almost wholly by persons from one foreign country. But even such persons blend their habits into the characteristic American ways to some extent, although

at the same time they remain true to type. Race usually shows itself in appearance.

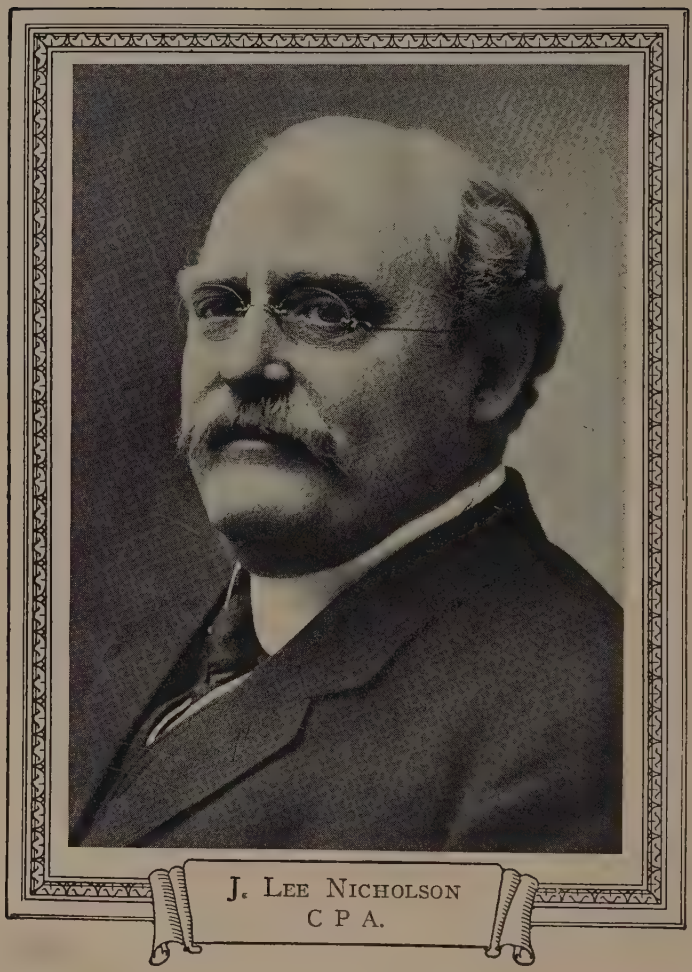
FIG. 17

Mingling of Races

When the working force consists of foreign-born people, it is very desirable from an employment standpoint that there be such a mingling of races in the shop that no favoritism may appear to be shown. A shop that is filled largely with Germans

is not a comfortable place for any but Germans to work. It is not perhaps so true of Italians from the northern part of Italy, but to some extent it is true of all races. Then, too, there is a great advantage in a proper mixture of races, because they thereby get acquainted with one another and they learn American manners and ways of doing things a great deal more rapidly than they can if those of each race are allowed to stick together. In getting such a mixture of races in a shop, one difficulty is met; that is in connection with the nationality of the foreman. Each foreman will be likely to have a preference for workmen of his own race. The one exception is perhaps the Irishman, who is willing to boss every race and only wants to be allowed to do it.

To arrive at a suitable mingling of races care should be taken to see that the proper proportion of races is obtained rather than merely a mingling of people from certain geographical divisions. For this reason, it is wise to make a brief study of the races that make up the working forces in this country, see where they live in the Old World, and what charactersitics they have that they are likely to retain and what can possibly be changed. Actual boundaries of countries change so rapidly, and have been changing for so long, that the name of the country can no longer be used to identify the race. The approximate locations of the principal races in Europe are indicated on the map, Fig. 17. The boundaries of the races, however, cannot be clearly defined.



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COST ACCOUNTING

COST ACCOUNTING UNDER THE NRA

The National Recovery Act was passed by Congress in June, 1933. As always, when the Government undertakes in any way to supervise business, the question at once arose as to how and to what extent the Act would affect various industries and trades, especially as to costs and cost accounting.

The Act, being an emergency measure, was given a life of two years. Probably no other legislation, especially as to its effect on business, has been so widely discussed. There seems to have been, or to be, scarcely an individual not affected in some way and who has not an opinion regarding this Act and its administration. Without doubt this Act, in some revamped form, will be perpetuated for years to come.

In a statement made on June 16, 1933, President Roosevelt said:

> "History probably will record the National Industrial Recovery Act as the most important and far-reaching legislation ever enacted by the American Congress. It represents a supreme effort to stablize for all time the many factors which make for the prosperity of the Nation and the preservation of American standards. Its goal is the assurance of a reasonable profit to industry and living wages for labor, with the elimination of the piratical methods and practices which have not only harassed honest business but also contributed to the ills of labor."

How clearly indeed this statement suggests the need of better management and cost accounting methods, if the goal of this Act is to be gained! That this was foreseen by the Administration is evident from the constant attention which has been given by the NRA and by the various codified industries to the problems of costs and their relation to phases of management.

The NRA provides the long-talked-of opportunity of self-government in industry, for the essence of the plan is that business groups, through their associations, shall set up codes for their own control and that these codes, when signed by the Administrator and the President, shall have the effect of law.

In the making of codes, industries take the initiative. While the general pattern of all codes is the same, there is always a difference in what is the most important phase in each. The industry and labor have different interests and viewpoints. Industrialists are not of one opinion as to all that is most desirable

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for industry as a whole, or even their own industry; also, the labor groups differ in opinions, too. Therefore, cost prices and sales prices, payrolls, and profits in terms of records and final results require consideration by both capital and labor.

In business, profits are the great incentive. When profits can be made, business expands, employment and production are increased, and standards of living advance. Profits are the difference between costs and income; the difference between all costs, and prices at which enough goods are sold to cover those costs, with a part of the income left over. It is always easy to believe that if there is a nominal difference between the cost of a particular article and its sales price, a profit is certain. It is this belief that has led manufacturers, at times, to compute costs, add a profit, fix prices, and wait for business which did not come, because the prices thus fixed were too high. Thus, there was brought about one form of overproduction and the useless tying up of capital. Since the success of a business depends upon profits, the price at which they will sell must be determined before goods are made and through a knowledge of costs it must also be determined if such goods can be produced and sold at a profit; if not, then the goods should not be made. This, then, is the reason why the National Recovery Administration has been urging cost accounting upon the business man.

Colonel Montgomery, the well-known accountant and economist, has said:

> "In a competitive system there is some connection between cost and prices but, unfortunately, no one has invented a system under which there can be any certainty that you can sell your products for more than they cost. We will never have a standard cost formula which will protect prices. You can only protect your prices by proper management of your materials and tools and by turning out goods of quality and usefulness and in such reasonable quantity as will not destroy your chances for profit."

There is close connection between these statements and the current price policies of the NRA. These policies are not announced as a magic formula for the guarantee of profits, but they are intended to give the facts to those who must have them in order to make decisions. The proposed plan makes it possible for an industry, if it chooses, to file prices with an impartial agency which, when filed, are to be made available to sellers and buyers. Price fixing seldom gives protection. The current

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policies, however, do provide for fixed prices when conditions arise that adversely affect small enterprises, wages, or labor conditions, or tend to monopolies.

These policies declare that the NRA will encourage proper cost accounting and accounting provisions in codes. New codes may provide that the code authority shall cause to be formulated methods of cost finding and accounting adapted to the use of all members of the industry. The use of such methods and principles, however, is not to be made compulsory.

The mere fact that an article costs a certain amount to make does not, necessarily, make it worth that sum. The idea that values are created by increasing costs is not good economics. Many men believe that they are entitled always to recover their costs, plus a profit, and that any additional costs will result in increasing the price of the product. Such men favor the idea of price fixing by agreement on the basis of costs. This is not correct thinking; prices are controlled by values, not by costs. What a man can afford to pay for the labor and materials which go into his product is determined by what purchasers are willing to pay for the product. There are three elements that must always be considered: selling price, cost, and volume. These elements are always interrelated; a change in one element is always accompanied by changes in the other two. Not always can it be told which change is a cause, and which change an effect. Volume of sales can nearly always be increased by lowering prices, or decreased by raising them. Stocks on hand may thus be somewhat, at least, controlled, and production regulated to seasonal or other conditions.

In connection with costs, prices, and price fixing, the fundamentals of cost accounting must not be lost from sight. Professor Herbert Taggart has well said:

> "The primary justification for cost accounting has always been and must continue to be that it is an essential tool of management. Cost accountants can make a good case for themselves, in the long run, only in this field. Cost accounting is not primarily a price-making device. The emphasis on this function is not healthy. Cost systems set up and installed with an eye single to price making are bound to lose caste when the emergency is over and the emphasis on prices as a basis of fair competition is past.
>
> "Cost accountants must continue, as in the past, to prove their worth to management on the ground that they furnish

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facts for the guidance of internal policies. They furnish data on what to produce and how to produce it; on who is efficient and who is not, and why; on wastes and losses and how to correct them; on savings and the rewards therefor; on what departments, branches, lines, and products are making money, and what are not."

The application of standard, uniform costs in the codes is a problem difficult of solution. This is especially so when a unit of any industrial group is so large as to be engaged in producing lines of goods used by it in large quantities. For example, an oil company may make (1) their own tin cans; (2) wooden or steel barrels; (3) boxes; (4) candles; (5) paint; (6) petroleum coke; (7) do their own construction work; (8) operate hundreds of trucks; (9) conduct service stations, and (10) maintain parking space conveniences. Of course, in the main, such a company would be subject to the oil code, but as each of the above ten items of business operations is also covered by a different code, complications arise, particularly as to the hours and wages for labor. Men, too, are often temporarily transferred from one type of work, or labor group, to another where the work hours are more or less per week, and at varying rates. Theoretically all this is more or less easily taken care of; but, in practice, it does not prove to be so. What code should apply? Are the men satisfied, and do they work effectively?

Since in such cases as the above each code authority may claim jurisdiction, decisions are often long delayed. These facts add to the many other difficulties encountered in installing and operating a cost-accounting system.

Martin A. Moore, Comptroller, Hyatt Roller Bearing Company, has recently stated the following specific points of advantages an industry may obtain from a uniform accounting plan:

"1. Those members of an industry who have no cost plan, or whose cost plan may be weak, will get the benefit of the sound cost-accounting principles embodied in a uniform plan. To that extent their policies will be predicated on accounting facts.

"2. It should promote better business methods and develop better business executives through a more general knowledge of the cost of doing business.

"3. It should eliminate to a great extent the uneconomic 'no profit' sales which contributed so greatly to the cut-throat competition of the 'New Era.'

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"4. It should provide for better stabilization of business and for a fuller appreciation of industry's social responsibilities through the possible development of comprehensive statistics on costs, wage rates, production, plant facilities, etc. It should furnish those individuals who have to a great degree a common problem a basis of facts from which to develop sound policies of 'economic morality.'

"5. It can provide bases of comparison as an aid to improving the effectiveness of individual units."

Every system of standard costs, to be uniform, must be based upon a definite plan laid down in an accounting manual giving the principles and methods to be followed. The Department of Manufacture of the Chamber of Commerce of the United States, Washington, D. C., has prepared much material along this line which may be reviewed with profit. An accounting manual should give the minimum requirements for a good accounting system and clearly define accounting terms in order that all the companies in an industry may include the same elements in the various stages of cost.

A good definition of cost accounting is essential. One uniform accounting plan defines cost as:

". . . the net outlay for material, labor, and expense in connection with the procuring, processing, marketing, and distribution of products, plus all other expenses incidental and necessary to the conduct of the business."

Total cost should be, and generally is, divided into two broad classes: manufacturing cost and general expense.

"The manufacturing cost of a product consists," according to one authority, "of the amount of the direct or productive labor and the net cost of direct or raw material (including inbound transportation) consumed directly in the fabrication of a product, plus an amount for manufacturing expense or burden, calculated in a scientific but practical manner and in accordance with the degree with which such product has utilized the plant and equipment and indirect organization in the fabrication."

The term "Commercial Expense" includes all expenses incurred in the marketing of the product and administering the affairs of the business. Under this heading come such: (a) Administrative Expenses; (b) Selling Expenses, and (c) Advertising Expenses as are properly allocable to.

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The elements in each group must be treated uniformly if the full benefits of a uniform system are to be obtained. There must also be a complete agreement as to the main divisions of a cost group, and clear explanations of the items included in each group.

A cost committee must develop a complete, all-inclusive definition of direct or productive material. In the cost plan of the Rubber Manufacturers' Association the following method is prescribed:

> "Material Cost shall be predetermined, utilizing the replacement value of the major raw materials. Such replacement prices shall represent the average future market price for each major raw material as quoted for delivery during the ensuing three months as supplied on the first day of each month by the Rubber Manufacturers' Association.
>
> "The replacement market price of raw materials shall be used without exception, even though such materials be procured from subsidiares or affiliated companies."

In factory burden is met the largest problem in classification in a uniform accounting plan. One uniform accounting plan defines factory burden as:

> "All those expenses made in connection with and incidental to manufacturing operations over and above the prime cost (prime cost being interpreted to mean direct labor and direct material)."

In the outline of cost-accounting principles for the Washing and Ironing Machine Manufacturing Industry, factory burden is classified as:

> "All expense incidental to the purchasing, receiving, movement and transfer of materials, parts, and product, their processing through to the shipping department and their planning and scheduling, routing, costing, time-keeping and recording in the processes of production. It will include a portion of administrative salaries and expense that can be fairly allocated to the cost of replacement parts furnished customers."

It is usual to classify the factory burden into major groups and then by means of sub-accounts, and still further divisions, provide for the needs of all members, regardless of the detail they may require.

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The main groupings in a factory burden classification may be as follows:

Indirect Labor	Maintenance
Factory Supplies	Losses, Errors, and Defects
Tools	Fixed Charges
Heat, Light, Water, Power	Miscellaneous

A study of the foregoing should help greatly in organizing a good definition of factory burden, and for its application to any uniform standard code accounting system.

Depreciation classification and policies are great problems in standard accounting-system plans. What shall be included? What shall be excluded? What policies shall govern the treatment of the various accounts? Improper handling of depreciation costs and uneconomic pricing methods have wrecked many an industry. A cost committee must first of all establish clearly what depreciation shall include. Then, of course, the proper rates of depreciation must be established for each plant item. With this problem is included a decision as to the method to be used in applying these rates; straight line, annuity method, production base, reducing plan, or sinking fund method.

The following is an example of Plant Account Classification and Schedule of Depreciation Rates as used in the January, 1934, classification of plant assets outlined in the Standard Accounting and Cost System for the Electrical Manufacturing Industry.

CLASSIFICATION OF PLANT ASSETS AND DEPRECIATION RATES

Classification	Per Cent
Land	0
Grading and Assessments	10
Building and Structures:	
Buildings, Wood, Sheet Iron, and Stucco	10
Buildings, Brick and Wood	4
Buildings, Steel and Concrete	2½
Structures	8⅓
General Service Piping and Wiring	6¼
Machinery and Tools:	
Machinery	8⅓
Electric Apparatus	8⅓
Ovens and Furnaces	10
Conveyor Equipment	16⅔
Small Tools	20
Electric Accessories	16⅔
Molds, Jigs, Dies, and Special Tools[1]	
Metal Flasks:	
Cast Iron, and Steel	12½
Channel and Rolled Steel	20
Aluminum	10

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Classification	Per Cent
Foundations and Installation:	
Foundations, Machinery and Electrical Apparatus	16⅔
Installations, Machinery and Electrical Apparatus	16⅔
Furniture and Fixtures:	
Factory Fixtures and Equipment	20
Furniture and Appliances in Factory Office	10
Transportation System:	
Roads and Sidewalks	12½
Railway Tracks and Overhead Equipment	6¼
Rolling Stock	6¼
Automobiles and Trucks (Gas)	25
Electric Vehicles and Trailers	16⅔
Other Conveyances	25
Patterns and Drawings:	
Patterns[1]	
Drawings[1]	
Unfinished Plant	0

[1]It is contemplated that the cost of molds, jigs, punches, dies, and special tools and cost of patterns and drawings will be charged to Unliquidated Development and Complaints and liquidated by charges to the cost of production to which they apply. At the option of the company these expenditures may be entered direct against indirect manufacturing expense under the proper headings.

There is much misunderstanding and confusion concerning the subject of uniform accounting, and particularly cost accounting. To many uniform accounting merely means price fixing. To others it means the effort of the large units of any industry to force all competitors to adopt an accounting system that will give these large units a practical monopoly. To yet others it means a force designed to bring about complete government control of all business. This large group base their idea of government compulsion upon the fact that the great majority of codes contain "fair practice price provisions."

Uniform accounting should, of course, mean uniformity in all accounting for the full benefits of accurate cost-finding methods, and results cannot be had unless there is a complete tying together of cost and the general accounting systems. Such uniform accounting must be based upon rules and procedures which will make it as easy as possible for any unit in an industry to ascertain its product's costs according to well-defined and accepted accounting principles.

One point that does seem quite generally agreed upon by cost accountants in nearly every industry is that uniform cost accounting cannot be forced on industry. Model cost-finding and accounting systems may be recommended in codes, but may not be made obligatory.

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COST ACCOUNTING

Essentials of a Cost System

IT NEEDS no argument to prove that system is far superior to a lack of it; yet many manufacturers do not fully realize how great might be the increase in the efficiency of their plant did they but possess a system of organization and management, which tends to provide the factory manager with complete information, so as to throw the searchlight on all the weak points in the problems of production.

The expense of a modern system need not be materially greater than that of an antiquated, crude, and inefficient way of keeping records. It is the worst sort of business extravagance to estimate, even where such estimate at the time is approximately correct, only to find at the end of the year that conditions changed after the estimate was made and that goods ignorantly sold below cost.

Cost Keeping and Cost Finding

The science of accounting is generally understood to deal with the financial transactions; it considers the elements of costs as proportions of percentages of the known total, and recognizes the product only in its relation to money value.

The science of cost finding, on the other hand, deals with product as accumulated units of production, considers the elements of costs in their relation to the product, and determines the cost per unit by comparing the sum of the elements of costs with the volume of units produced. Accounting takes a total and determines the proportions of its elements; cost finding begins with the elements and determines the total.

Therefore, it might be said that cost accounting is a system of accounting that deals with the recording in detail of the transactions arising from, and having to do with, the manufacture of the product and the summarizing of these details in such a manner as to be controlled by the financial books. This definition covers what might be termed a *complete cost system.*

To be fully effective, the cost records must be a part of the general system of accounting. They must "match up" with the general books. Independent of this, the cost accounts may supply data of considerable importance, but they cannot be so far-

reaching, so fully effective, and of so much value to the factory management as they could and should be.

In 1911 cost accounting was desirable, by 1921 it became necessary, in 1931 it is indispensable for a progressive corporation. The depression of 1930-1931 forces executives to discover just which departments pay, and how much. Taking the "guess work" out of business is the order of the day.

Advantages of a Cost System

A cost system is often looked on as a means of obtaining the cost of production only. This is a wrong impression, as the information is extremely valuable in other ways.

A cost system shows upon what lines profits are made, and upon what lines losses are incurred. It furnishes the necessary data incident to reducing costs, either by eliminating certain unnecessary expenses or by increasing the production of various departments in which inefficiency, as indicated by the system, is shown. A cost system serves as a basis for judging the efficiency or inefficiency of each plant, of each department, of each foreman, or of each group of men.

A cost system supplies the proprietors with the information requisite for the building up of an increased business, and takes the place of the personal touch they had with its details in the early days of their operations, but now beyond their personal supervision.

It serves as the basis for determining selling prices. With a definite knowledge of the cost of an article, the sales department could push the sale where it is known that the most profit will be made and retard the sale of the article on which a loss is incurred. By means of a cost system a perpetual inventory is kept, thereby enabling a loss-and-gain statement to be made semiannually, quarterly, or even monthly without the taking of a physical inventory.

PROCEDURE IN COST DETERMINATION

Methods

The importance and the desirability of accurate methods of ascertaining the cost of production are generally conceded. The accuracy and effectiveness with which this is done rest on (1) the methods used and (2) the principles involved. Cost-finding methods are divided into two classes: (1) estimating-cost methods and (2) actual-cost methods. The estimating-cost

method consists generally in estimating a certain amount of material, a certain amount of labor, and a percentage to cover overhead expenses in arriving at the cost of any article. The weakness, however, in most of the estimating-cost systems in use, is that they lack all elements of proof.

Principles and Conditions

There are two fundamental principles of cost accounting, and the application of these two principles, according to one or the other of two general conditions, will embrace every line of manufacture. The two fundamental principles are: (1) The productive-labor method of cost finding (hours or wages), and (2) the machine, or process, method of cost finding. The two general conditions are: (1) The special-order system and (2) the product system.

In order to link the two cost-accounting principles to the two conditions of manufacture, the special-order system may be linked to the productive-labor method of cost finding or to the machine, or process, method of cost finding. The product system may also be used in connection with the productive-labor method of cost finding or the process, or machine, method of cost finding.

The term special-order system means that system of cost accounting in which the elements of cost are charged to an order, a job, or an article. The product system is that type of system in which the costs are charged to the product or the process without relation to any order or article.

The productive-labor method of cost finding is applicable to those plants in which the productive labor is the essential feature of the production. The process, or machine, cost method is applied to those plants in which the product is made by machinery, and in which the labor is merely an incident in connection with the supervision of the machines and not of the production.

The preceding principles governing cost finding are practically the same in every line of manufacturing, but their application in methods and forms with which the data is compiled is different in each case, not only on account of the difference in the manufactured product and conditions of the plant, but also on account of the different methods used by the one who devises the system.

ELEMENTS OF COST

Classification and Explanation

The elements that comprise the cost in all manufacturing enterprises are made up of three principal divisions: (1) Material; (2) labor; and (3) indirect expense. The first two of these divisions may be subdivided into *direct* and *indirect.*

Direct material is that material which enters into the product itself and can be charged accurately to the article. Indirect material consists of such material as factory supplies used in the processes, but which do not enter into the product itself. These and also material that does enter into the product, but which it is impractical to charge as a direct-material cost, are not chargeable directly to any one article, but must be distributed over the number of articles affected by their use.

Direct, or productive, labor is limited to that labor which is actually expended on producing the article manufactured. All forms of labor, such as repairing, handling, supervising, etc., that are not engaged directly on the article itself, are designated as indirect labor. As in the case of indirect material, the expense of this non-productive labor is distributed over that part of the production which is indirectly affected by it.

Indirect expense, together with indirect material and indirect labor, compose the last element of cost, which is sometimes called *burden* and sometimes *overhead.* This large element of cost must be distributed accurately, by some known ratio, over the production, if correct costs are to be obtained.

Indirect expenses, as a whole, consist of (1) indirect labor; (2) indirect material in the way of supplies, etc., and (3) indirect expense, comprising supervision and all labor not employed directly on the product, such as light, heat, power, freight, express and cartage inward when not charged directly to material cost, maintenance, insurance, taxes, interest, rent, depreciation, and, in short, any factory expense that does not enter into the product itself. These are divisible into two general classes. One of these classes can be apportioned to certain products or parts of products because they are incurred in a particular department of the factory. The other class consists of such expenses as are incurred for the benefit of the entire plant, and must be distributed over all departments on an equitable basis. If the selling and administrative expenses are added to the factory cost, the cost of marketing the article will be obtained, and, if the profit is added to this, the result will be the actual selling price.

Diagram From Cost to Selling Price

The relation between the different elements of expense to a manufacturer may be illustrated by a simple diagram, Fig. 1, which, in the light of what has been said, is self-explanatory.

Determination and Distribution of Indirect Expense

The cost of direct material is a matter of market price at the time of purchase, and by calculating the amount of product manufactured out of a certain supply of raw material, this part of the prime cost is determined. The direct labor cost is not very difficult to calculate. In fact, in piece work it is given

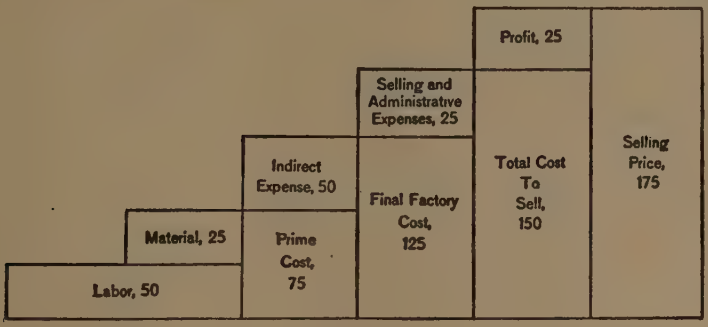


FIG. 1

directly on the product without further calculation, unless there is required the addition of the cost of several parts or processes to find the cost of the whole. But in the majority of cases it is quite a different matter with the more indefinite elements, *indirect expense;* and when it is considered that this expense will run from 50 to 350 per cent. of the direct labor, according to the conditions of manufacture, it can be readily understood that too great care cannot be used in the determination and distribution of this division of factory cost.

Classification of Items

The first step toward making the proper distribution of indirect expense is to classify into various divisions the items that comprise it, after the manner mentioned previously. As a rule, this classification will vary in the application to different factories. Now, since the distribution must be added to the direct labor and material, there must be a suitable classification of these elements also, in order that the theory may be carried out.

Division of Factory Departments

The next step is to divide the factory into a number of operating departments, according to the processes of manufacture. It should be the aim to limit each department to operations that are as simple and uniform as possible. Where the processes in the same department differ in any appreciable degree, the same difficulty arises that existed before the classification was made, and to avoid which it was undertaken at all.

In certain kinds of textile mills, the operating departments would be as follows: Sorting, scouring, carbonizing, drying, picking, carding, spinning, knitting, rib knitting, seaming, dyeing, boarding, finishing, box, and packing.

Likewise, in a certain class of stove manufactories there would be the following departments: Pattern, core, foundry (which may be divided into two departments, as coupola and molding), cleaning, polishing, nickeling, tin shop, and mounting (assembling).

In a machine shop, the departments may sometimes be divided into the following: Foundry, tool, paint, pattern, polishing, planer, lathe, woodworking, and assembling.

Department Cost

It is evident that the cost of any article in any one department can be obtained by the addition of four distinct elements of cost in that department, namely, (1) direct material; (2) direct labor; (3) department indirect expense; and (4) general indirect expense, that is, its share of the general indirect expenses of the plant that cannot be charged against a department but must be distributed pro rata over the several departments.

The usual method of adding a certain percentage upon every article manufactured to cover all indirect cost is wrong in principle. The indirect cost is not the same for each class of articles, unless the factory limits itself to manufacturing a single uniform product; and even here, the manufacturer cannot tell the true cost of a certain process to which the product is subject unless the indirect expenses are distributed over the several departments. Some departments have more indirect expenses than others. For instance, the number and salary of foremen may be greater in one department than in another, or one department may require extra floor space, etc.; and in the same manner such items as indirect labor, power, and supplies vary considerably in different departments.

Again, not all articles pass through all the departments or

the same departments, and the charge for indirect expenses varies accordingly. To illustrate this, let it be assumed that there are five operating departments in a certain factory. While one class of product may pass through all five of these departments, another may pass through only three. It is evident that by charging a fixed percentage for indirect expenses on all articles, the product that passes through only three departments is being charged the same percentage as the product that passes through all five. From this, it can be clearly seen that unless the indirect expense is applied, first, to the department in which it occurs, and, after this, by the departmental distribution of the general indirect expenses of the whole plant, the accurate cost cannot be known.

Costs should therefore be recorded into each operating department under the general headings mentioned previously; namely, (1) direct material; (2) direct labor; (3) indirect expense applying to each department; and (4) that part of the general indirect expense which is prorated over each department.

Elements of Indirect Expense

The light, heat, and power of a plant are usually distributed from one or more centers, and, in order to get at the approximate cost for the running of each department, it is necessary to arrive at some ratio with which each department is to be charged. Once the ratio is obtained, the expenditures relating to this particular phase of indirect expense may be divided among the different departments. It should be noted, however, that this ratio cannot be determined on a long-time period, as there are very often considerable intervals when some of the machines of a department are not running, and this would make a difference in the actual distribution.

Interest

Interest on investment in a plant is very rarely included in the cost of manufacture, and there is a difference of opinion among accountants as to whether interest should be included in the cost. When interest is included in the cost, there are two principal ways in which it enters as an expense: (1) The interest on the amount of capital invested, represented by the plant equipment; and (2) where all or any part of a plant is owned subject to mortgages or notes, the interest in this case practically taking the place of rent. The necessity of a proper distribution of this expense departmentally can readily be understood; one department may contain very expensive

machines, while those in another department may be inexpensive. Thus, the ratio of distribution of interest expense should be based on the then present value of the equipment in the different departments.

Depreciation

The next element of indirect expense, namely, depreciation, is the most complex and difficult to estimate. Not that the principles involved are inexact or hard to understand, but the actual rate of depreciation depends on so many different and variable factors that it is out of the question to set better than an approximate figure.

Some of the more important of these factors are: (1) The nature and construction of buildings and equipment, together with their conditions; (2) the deterioration of plant in general and of machinery in particular, due to wear and tear; (3) the amount spent for maintenance in the way of repairs and renewals; (4) the invention of new methods or new machines that may or may not entirely replace the old ones; and (5) the permanency of business, and likelihood of increase or decrease in the same.

Depreciation, as a term, may be defined as loss in value. This loss may be due to age, use, or a combination of these two with several contributory causes. In applying depreciation to the product, the same general principles hold good as in other forms of indirect expenses. As far as possible the depreciation that occurs in one department should be charged to the articles passing through that department, the remaining depreciation to be prorated over the whole plant in the same ratio as the other general operating expenses.

The usual method of calculating an average depreciation is to "write off" each year a certain per cent. of the value of the machine or the plant as a whole, thus providing for an actual decrease in value. When this method is applied to a plant as a whole, it is known as the *blanket method.* This is a very simple way, practically applicable to very simple conditions; but it breaks down and gives results far from the truth in large and complex factories.

There is still another way of approaching the depreciation question, which is by the creation of a *reserve fund.* This takes the form of a fund set aside out of the profits, to provide for all repairs and renewals as they are needed. To cover the estimate of depreciation it should be equal to it in amount. This plan has the merit of providing for the depreciation of the plant

Analysis of Elements of Cost

The analysis of the elements of cost shown herewith, shows the items that usually comprise the various divisions illustrated in Fig. 1.

Direct material	.....				
Direct labor	.....				
Prime cost		.....			
Indirect Materials:					
Material that cannot be directly assigned to a definite part of the product	.....				
Supplies	.....				
Small tools, etc.	.....	.....			
Indirect labor:					
Labor not directly engaged upon the product	.....				
Superintendence and supervision	.....				
Inspection and experimental work when not treated as direct salaries of factory clerks	.....				
Defective work	.....	.....			
Indirect expense:					
Rent, power, light, heat	.....				
Taxes, insurance	.....				
Interest, depreciation	.....				
Maintenance and repairs	.....				
Freight and cartage inward, if not treated as a direct material cost	.....				
Over, short, and damage	.....				
Sundry unclassified expenses	.....	.....			
Factory cost			.....		
Selling expenses:					
Advertising			.....		
Cost of samples			.....		
Salaries and commissions			.....		
Traveling expenses			.....		
Office rent			.....		
Salaries of clerks			.....		
Insurance, taxes			.....		
Telephone and telegrams			.....		
Stationery and printing			.....		
Postage and parcel post			.....		
Cartage and freight on outward shipments and deliveries			.....		
Expenses of shipping department (qualified)			.....		
Expenses of finished-stock warehouse (qualified)			.....		
Sundry unclassified expenses			.....	.....	
Administrative expenses:					
Salaries of officers and executives			.....		
Legal expenses			.....		
Auditing expenses			.....		
Office rent			.....		
Salaries of clerks			.....		
Light, heat, insurance				.....	
Telephone and telegrams			.....		
Stationery and printing			.....		
Postage, office supplies			.....		
Sundry unclassified expenses			.....	.....	
Total cost					.....
Profit					.....
Selling Price					.....

without changing the figures of the original valuation on the books. The reserve, so set aside, adds nothing to the resources of the company; it is purely a method of providing for depreciation charges before they actually eventuate in expenses for repairs. The charges themselves are assessed on the product and go to increase the cost of production as a true indirect expense. Indirect expense, far from being a minor item, is quite on a par with material or labor cost, if not actually more important. It is unquestionably the most difficult to analyze and reduce to figures, and even with this accomplished the problem is only half completed. The question still remains, how to apply this expense to the manufactured product in such a way as to reveal the true cost of production of the separate articles or classes of articles. Thus, the correct distribution of the indirect expenses becomes one of the essential links in the chain of process used in cost finding, without which no results can be depended on as accurate.

Various methods of effecting this distribution have been proposed. These methods vary widely in theory and involve distinctly different processes in execution. There are now several methods recognized as standard, each one of which is suitable to certain conditions while being altogether out of place when adopted apart from these conditions.

When it comes to the point of actually choosing a method of distribution in a concrete instance, the manufacturer is generally confronted by a variety of conditions and circumstances, apparently peculiar to his own plant. It is to meet the latter difficulty that the plan of dividing the factory into departments was devised. Each department should be so formed that the expenses connected with it may be grouped and treated departmentally. This suggests the idea that different methods of distribution may be used in the same factory in different departments; and this is actually done in some cases.

Standard Methods

In considering the standard methods of distributing indirect expense, it will be advantageous to keep clearly in mind the distinction between *departmental distribution* and *distribution over the whole.* The majority of manufacturers using any one of these methods apply it, in connection with the rate obtained, to the production of the entire plant, without reference to the varying conditions governing the manufacture of different classes of product. Much of the following description has been written in accordance with this general point of view, and many of the criticisms do not apply if the use of the method is limited to

those departments in which conditions are in harmony with its principle of operation.

DISTRIBUTION OF INDIRECT EXPENSES

Direct-Labor-Cost Method

By reason of its simplicity, the direct-labor-cost method of distributing indirect expenses is in more general use than any other. It is based on the principle that the product increases in value according to the amount of labor added to this product, and that the greater the amount of labor involved in the manufacture, the greater the expense required to supervise this labor and conduct the business.

The plan generally adopted in operating the direct-labor-cost method is, first, to ascertain the total cost of direct labor actually charged to the product. The total indirect expense for the same period is then divided by the total direct labor. The result shows the per cent., or rate, that the indirect expenses bear to the total productive labor. The distribution is then made over the articles manufactured during the period embraced in the calculations by multiplying the total labor charged to each article by the per cent., or rate, of the indirect expenses. In this way, as will be seen, each article will be charged with a part of the indirect expense of the entire plant, according to the cost of labor expended in its manufacture.

In Fig. 2 is shown a statement of factory expenditures that will serve to illustrate the manner in which the department charges in the direct-labor-cost method are classified and arranged in shape suitable for application. Under the heading Accounts are placed the names of the several departments, and the different items of expenses are listed at the left of the sheet. The account of general operating expenses, covering the indirect expenses of the plant at large, is shown in the lower section of the statement, and the distribution of these expenses is recorded at the right. The per cent., or rate, of distribution, determines the actual amount for each department. The items found in this part of the distribution blank are seen again in the upper form, each placed in the proper department on the line designed as General Operating Expenses.

Direct-Labor-Hours Method

The difference between the direct-labor-hours method and the method just described lies in the basis used in determining

STATEMENT OF FACTORY EXPENDITURES

For the month of _____ 19__

Accounts	Department 1	2	3	4	5	6	7	Total
Direct:-								
Material	5 166 80	42 38	634 12	3 046 32			119 30	8 898 92
Labor	4 018 38	292 94	1 370 80	2 867 98	1 093 66	412 70	879 94	10 936 40
Total	9 175 18	335 32	1 904 92	5 914 30	1 093 66	412 70	999 24	19 836 32
Indirect:-								
Labor	851 78	197 62	836 52	268 94				1 859 86
Supervision	312 42	8 60	179 50	190 22	59 34	24 64	200 82	976 44
Supplies	578 96	3 26	71 62	186 72	108 96	292 84	86 16	1 328 48
Light, Heat and Power	2 890 40	37 48	129 48	230 00	71 50	180 18	84 64	3 623 98
Freight, Express & Cartage (Inward)	22 44	6 06	10 62	18 80	5 88	2 46	7 02	70 84
Maintenance	1 303 10	177 22	616 72	1 095 36	341 86	148 90	407 68	4 084 84
Incidentals			64 10			45 90		110 00
Depreciation	849 26		283 08	566 18	94 36	94 36		1 887 24
General Operating Expenses	803 67	68 68	274 16	573 59	218 73	82 64	175 98	2 187 25
Total	7 612 03	435 72	2 101 54	3 118 97	900 93	885 82	902 30	16 107 51
Total Expenditures								35 943 83
Material-Finished and in Process (beginning of period)								49 444 86
Grand Total								85 387 49
Cost of Sales								35 790 06
Material-Finished and in Process (end of period)								49 697 43

Store Room

Operations	Amount
Inventory (beginning of period)	26 175 58
Purchases	19 162 58
Total	45 338 16
Delivered to Operating Depts	8 898 92
Inventory of Raw Material at end of period	36 437 24

Operating Expenses

Account	Amount	Total
Superintendence		184 32
General Labor		967 19
Light, Heat and Power		136 23
Insurance		376 14
Taxes		245 83
Freight, Express & Cartage (Inward)		109 45
Factory Supplies		16 21
Salaries of Factory Office Clerks		115 00
Factory Office Supplies		10 72
Incidentals		27 16
Total		2 187 25

Distribution

Departments	%	Amount
No. 1	20	803 67
2	20	58 68
3	20	274 16
4	20	573 59
5	20	218 73
6	20	82 64
7	20	175 98
Total		2 187 25

APPROVED: _____ CORRECT: _____

FIG. 2

the rate of distribution; otherwise, there is a general similarity in outline and application. Both are averaging methods, and the theory of the labor-hours method admits the principle before stated, namely, that an article increases in value in proportion to the amount of labor expended on it. However, in this method, it is contended that *time*, and not cost, is the essence of the amount of labor, and that the actual cost for the time is merely incidental, or, at most, proportional; that is to say, the indirect expenses of a plant are in keeping with the number of employes and the hours they work, rather than with the wages they receive.

The plan of procedure in the labor-hours method is to divide the total indirect expenses by the number of productive-hours—that is, the hours charged to the product direct—and thus ascertain the amount per hour to be added to the cost of the product to cover indirect expenses.

Both the labor-cost and the labor-hour methods are imperfect. If a method of distributing the indirect expenses is to produce accurate results, the element or elements on which it is based must represent conditions actually existing. It is clear that neither of these two methods is based on this principle, and they do not represent actual conditions except in two instances, namely, where the product and the processes of manufacture are both very simple and uniform in character, and where the distribution is made departmentally. Whatever the principle of a method is, the results will always be inaccurate unless it is applied in such a way as to identify the product produced in a department with the expenses peculiar to that department. No system based merely on an average percentage of the entire plant can overcome this objection.

Direct-Labor-and-Material Method

The plan of procedure in the direct-labor-and-material method is similar to that in the labor-cost method, but it uses the total cost of labor and material as the basis of the calculations. It is essentially an averaging method, and is rarely used in any other way. To be at all successful, the material should constitute by far the greater part of the direct cost. If the direct labor is a comparatively small part of the prime cost, and the material and indirect expenses are principal factors, this method might seem practical, subject always to the limitations of averaging methods.

If the method is adopted where these conditions do not exist —that is, where the direct labor constitutes an important part of

the cost—the results will be further from the truth than those obtained by any other of the methods described.

Old-Machine-Rate Method

Under the old-machine-rate method there are obtained the total indirect expenses and the total number of hours in which machines have been in operation. The total indirect expenses are then divided by the number of machine hours to get the rate per machine hour for indirect expenses.

This plan may be used to advantage wherever all the machines are of one kind; that is, when they occupy substantially the same floor space, use approximately the same amount of power, and cost approximately the same.

New-Machine-Rate Method

In outlining the various methods now in use for distributing indirect expenses, the plans mentioned are, perhaps, most valuable when used departmentally. As has already been stated, the best method of distributing indirect expenses is that which minimizes the amount of indirect expense to be prorated on a more or less arbitrary basis. By this is meant a method that will localize or centralize the expenses ordinarily termed indirect in such a way as to make it possible to charge these expenses to the product directly, instead of indirectly, and thus reduce the amount that would ordinarily have to be prorated over the production. Consequently, any method, or plan, that provides for charging directly the greatest amount of expense is the most desirable one to adopt.

The new-machine-rate method was devised with this end especially in view. Where it can be applied, the results may be said to be as near the true costs as it is possible to get. But attention should be called at the outset to the fact that the method is limited to those factories or plants in which the majority of operations are machine processes. It must fail when applied where there is a considerable amount of bench work, or where machines are only incidental to the real process.

The plan of procedure of the new-machine-rate method provides for charging the labor and all departmental expenses directly to a process or a machine in such a way as to show the total cost per hour of operating the machine or process. This includes such general operating expenses as do not pertain directly to the machine or process in question, but can nevertheless be associated indirectly with its operation. The rate thus

ascertained is charged to the cost of the product, the total charge depending on the length of time consumed in the production.

After the classification or standardization of operation has been determined on, all operations or processes should be charged with the full time of employes engaged therein, as well as with any supplies or repairs relating to them. In addition to this, insurance, floor space, depreciation, interest on investment, and any or all other items connected with the manufacture of the product and incident to the operation should also be charged. The charges just mentioned relate to expenditures that can be identified absolutely as relating to the machine or process.

When all these charges have been made, the general indirect expenses, or expenses that are not and cannot be properly charged to any particular machine or process, should be distributed among the various departments according to some established basis. Each department in turn applies these general expenses to the product.

Now that the total cost has been charged to the various machines or operations, the next step to be taken is to determine the number of operating hours of the machines or process. From this is ascertained the cost per hour per unit of measure, so that the product passing through these various operations may be charged at this rate. All expenditures chargeable to the product, except material, will then be included for the particular operation or process.

The working plan of the new-machine-rate method may now be summarized as follows:

1. All expenses that can be possibly charged to machines or processes are so charged. This includes labor, supplies, interests, etc., as outlined previously. It is this step that constitutes the essence of this method.
2. The general indirect expenses are distributed among the different departments, and are then added to the department indirect expenses.
3. The total department indirect expenses are then distributed over the machines or processes.
4. By combining the charges of one and three, the total machine rate is determined. This rate includes all items of cost except cost of material.

To find the cost of any article is a simple process. Suppose it to pass through several departments or processes. The number of hours it is operated on in each process, multiplied by

the machine rate for that process, gives the different process costs.

To the sum of these, or the total process cost, add the material cost, taken from the invoice or material requisition, and the final, or factory cost, is obtained.

If the principles of the new-machine-rate plan are applied through the operator of the machine instead of through the machine itself, a similar method of finding costs will be developed. It is known as the *sold-hour plan.*

Fixed-Machine-Rate Method

The essential step in the fixed-machine-rate method consists in the preparation of rates, which are obtained departmentally—either from the results furnished by a system previously operated or from an investigation and analysis of the expenses known—to be chargeable to particular machines or processes. These charges are then calculated according to the maximum operating machine time.

The machine rate thus obtained is then charged to the cost each month and credited to the department indirect-expense account, irrespective of the actual cost per hour, as shown by the actual charges and the actual machine time. This department indirect-expense account consists of the sum of the machine rates for a given period, and is supposed to include all the indirect expenses connected with the department as such. The general indirect expenses are not distributed departmentally in this method, but by a supplementary rate, which, as generally used, covers the whole factory. In this supplementary distribution, any desired method can be employed, such as labor cost, labor hours, etc.

After these rates have been obtained, and the machines or processes to comprise the system classified, the actual charges relating to the machines or processes, which are presumably included in the rate, are determined.

New-Pay-Rate Method

The principles underlying the new-pay-rate method are the same as those underlying the direct-labor-cost method, but they are applied differently. The indirect expenses relating to a particular department are ascertained separately, and the general operating expenses are distributed among the departments on the basis of direct-labor cost before the percentage of indirect expense of each department is calculated. The total depart-

ment indirect expenses are then applied separately to the product manufactured in each of these departments, but in a different manner than has yet been described.

The chief feature of the new-pay-rate plan is that, after the indirect expenses are determined departmentally, instead of charging them as percentages to the product of these departments, they are added as separate rates to the rates of pay of the employes engaged in each department. The new rate, which includes indirect expenses, is charged to the product by multiplying the employe's time consumed in the operation by the new rate, instead of first charging or extending the amount of labor cost and then adding the percentage for indirect expenses.

FORMS FOR RECORDS OF MATERIAL

The *forms*, or *blanks*, required in a cost-accounting system are large in number.

Following are a number of forms for the purchasing and recording of materials.

Purchase Requisitions and Orders

A purchase requisition is for the purpose of requesting the purchase of material or supplies by the person in charge of the department requiring them. The form is made in duplicate, the original being sent to the purchasing department, and the duplicate kept on file by the department until the goods ordered have been received. This requisition, however, should be passed on by the person in charge of the stock records, who should only approve of the purchasing, provided the condition of the stock on hand justifies the purchase.

Fig. 3 shows what is probably the simplest purchase-requisition form that can be devised for the purpose intended; Fig. 4 shows a form with a little different classification.

The purchase order is usually made out in duplicate by the Purchasing Department on receipt of the purchase requisition. The original is sent to the seller, and the duplicate is kept on file until the goods ordered have been received. When the goods have been received, the material-received sheet, reporting the receipt of the goods, should be attached to the duplicate, which, after being recorded by the cost or stock clerk, should be attached to the invoice and placed on file.

Fig. 5 illustrates the style of form in general use for all ordinary purposes. Figs. 6 and 7 show the original and duplicate,

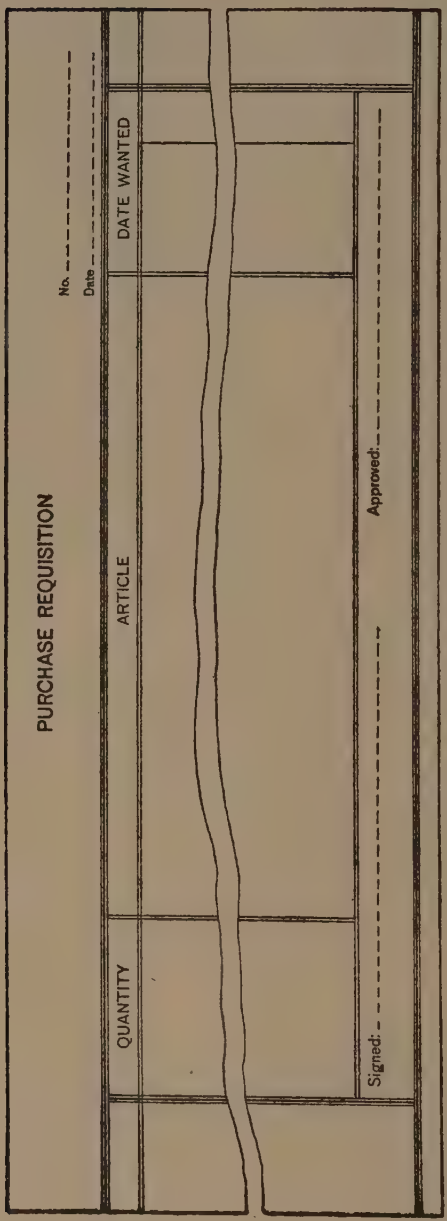

PURCHASE REQUISITION
No.
Date
QUANTITY
ARTICLE
DATE WANTED
Signed:
Approved:

FIG. 3

Purchase Requisition

No. _____

To _____
Purchasing Agent

_____ 19____

Please order the following articles for the use of _____

Purchasing Department	
Ordered	
Purchase Order No.	

DESCRIPTION					
FROM	ARTICLE	QUANTITY	DATE WANTED		APPROVAL OF COST DEPT.

Ordered by: _____ Approved by: _____

FIG. 4

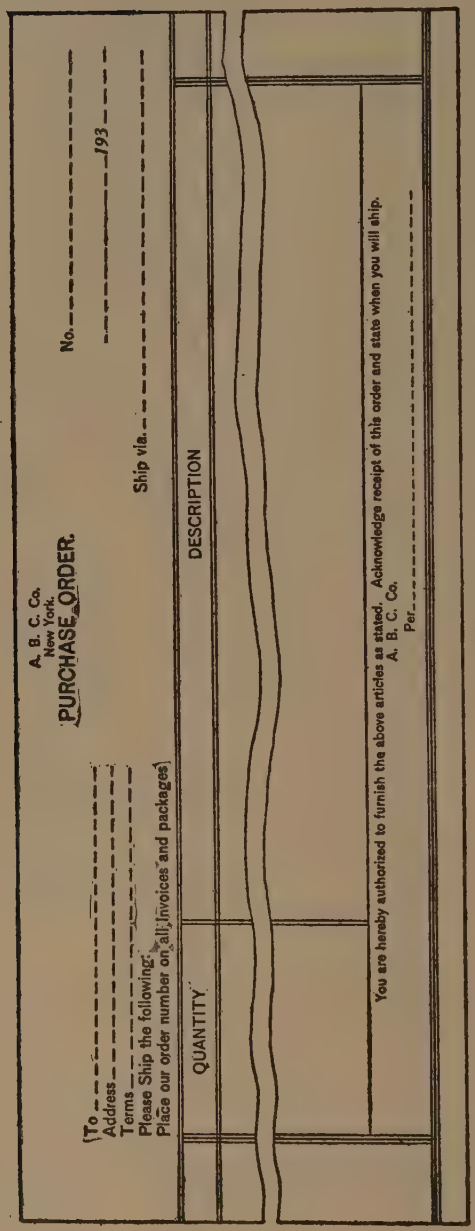

A. B. C. Co.
New York.
PURCHASE ORDER.
No.
193
To
Address
Terms
Please Ship the following:
Place our order number on all invoices and packages
Ship via
QUANTITY
DESCRIPTION
You are hereby authorized to furnish the above articles as stated. Acknowledge receipt of this order and state when you will ship.
A. B. C. Co.
Per

FIG. 5

respectively, of the style of form employed when the amount purchased is to be charged to a specified order number. This kind of purchase order should be made out in triplicate, and the

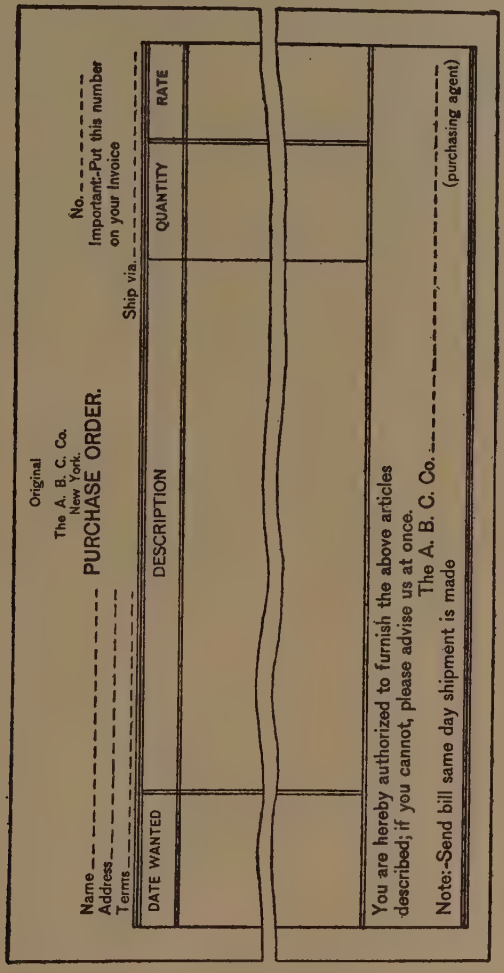
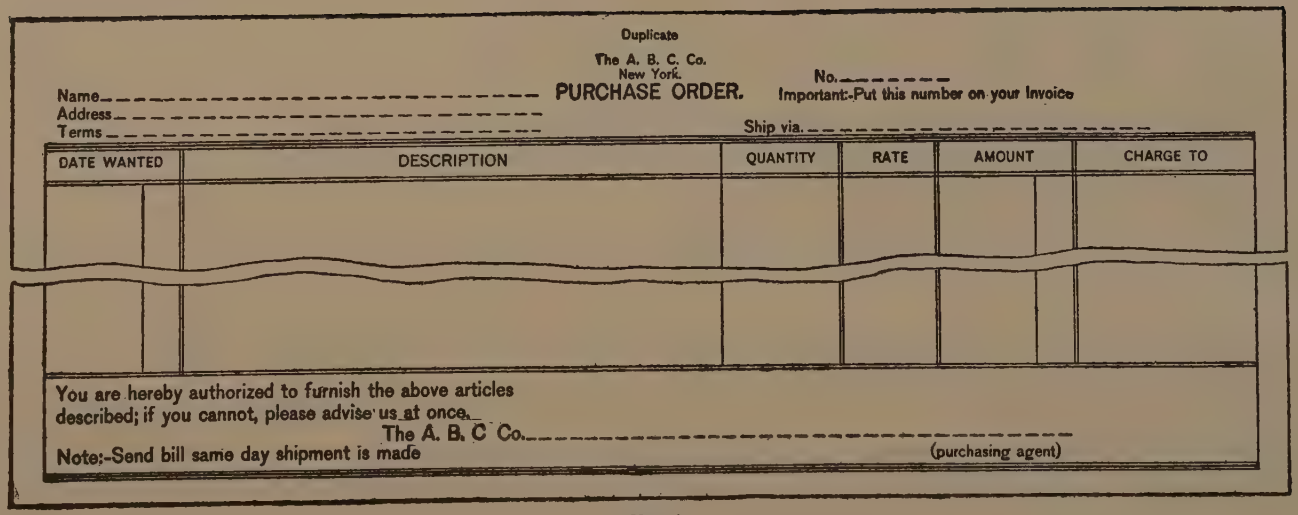


FIG. 6

third copy should go to the cost clerk at the time the purchase order is made out.

Material-Received Sheet

The material-received form is made out by the receiving clerk, and it should show the actual quantity of material



Duplicate

The A. B. C. Co.
New York.

Name_____ PURCHASE ORDER. No._____
Address_____ Important:-Put this number on your Invoice
Terms_____ Ship via._____

DATE WANTED	DESCRIPTION	QUANTITY	RATE	AMOUNT	CHARGE TO

You are hereby authorized to furnish the above articles described; if you cannot, please advise us at once.

The A. B. C Co._____

Note:-Send bill same day shipment is made (purchasing agent)

FIG. 7

received, regardless of the amount of goods recorded on the invoice.

In certain industries it is impractical to count the material when received, in which cases the invoice must be accepted for the time being as the record of goods received. Usually, the goods are opened in some particular operating department of the plant at the time they are to be used, when the mate-

Original

REPORT OF MATERIAL RECEIVED

Purchase Order No. _____ No. _____
Requisition No. _____ DATE _____
Received from _____

CLASSIFICATION NO.	QUANTITY	DESCRIPTION	CHARGE TO

Invoice _____ 19 ___ Received by _____
Entered _____

FIG. 8

rial-received record is made out and a claim made for shortages if there are any. All claims relating to the description of the goods are made out by the receiving clerk.

In another method used in connection with recording the receipt of incoming material, the quantity ordered is left blank on the copy of the purchase order given to the receiving clerk; that is, this copy shows merely the description of the goods. The material-received sheet, together with the copy of the purchase requisition, purchase order, and invoice, is filed away, making a complete record of the transactions. This method gives a complete check on all entries relating to purchasing, as the purchase order is made out by one person, the receiving report by another, and the invoice by an independent concern, the record made by each person must check with those of the other two.

The duplicate copy of the material-received sheet should go to the stock clerk for entry, and if the material is charged to a specific order number, the copy should be used by the cost clerk also. A form similar to those shown in Figs. 8 and 9

may be used if the material is purchased f. o. b. purchasing point, or if the freight charges are so small as not to affect the

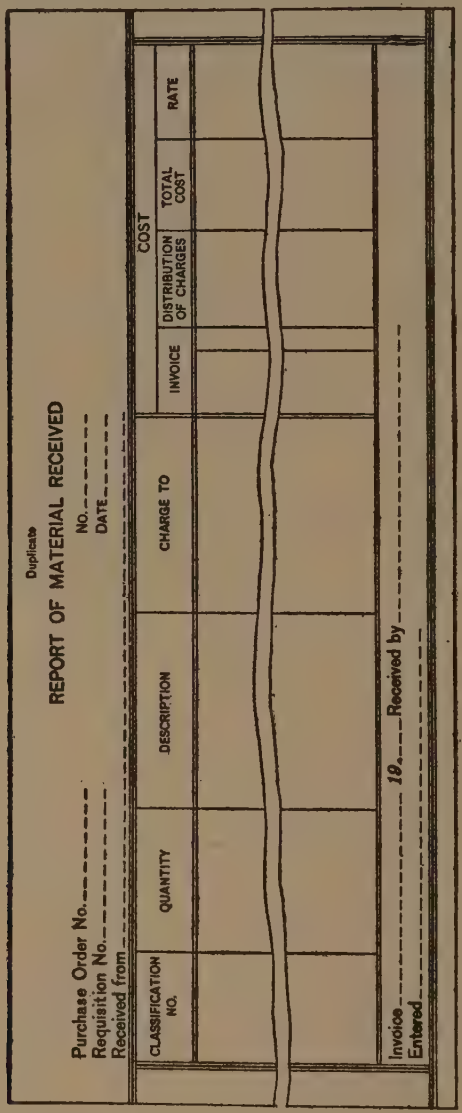
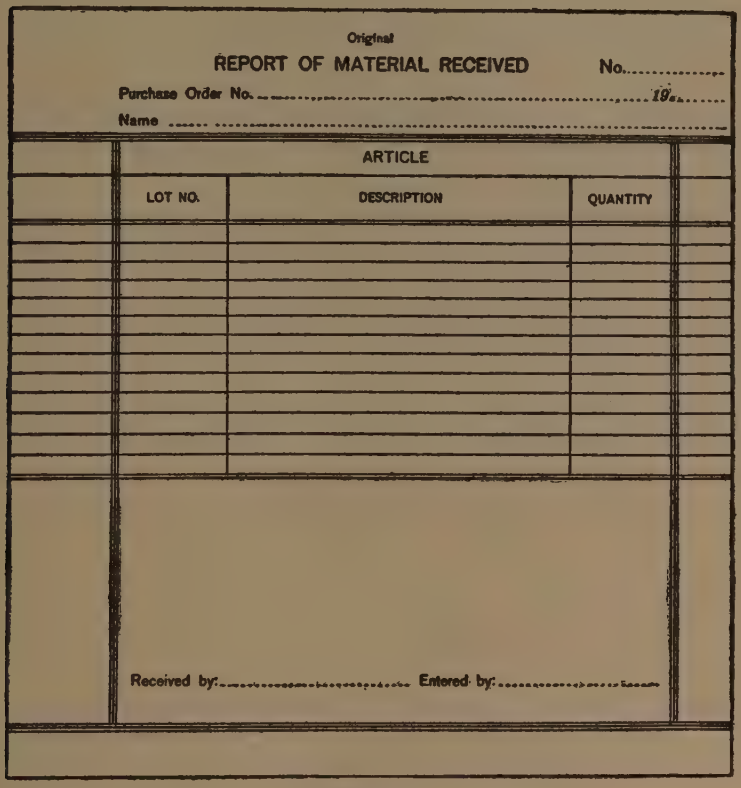


FIG. 9

price of the material. If the goods are purchased f. o. b. shipping point and heavy charges for transportation are incurred by the buyer, thus affecting the actual cost of the article, it

will be found convenient to use a form similar to those shown in Figs. 10 and 11. The distribution of the freight charges may then be made directly on the material-received report without copying the information on some other form for calculation and distribution.



Original

REPORT OF MATERIAL RECEIVED No.....

Purchase Order No. ..... 19...

Name .....

ARTICLE		
LOT NO.	DESCRIPTION	QUANTITY

Received by:..... Entered by:.....

FIG. 10

The copy of the material-received sheet, together with the invoice, should be used by the bookkeeper in making the entry on the accounts-payable voucher for entering into the register of accounts payable or the invoice register.

Stock Record of Raw Material

Stock records of raw material are intended for the compilation of information obtainable from the forms previously mentioned, as well as for the recording of information regarding material used or goods taken out of stock (see Figs. 12 and 13).

Duplicate

REPORT OF MATERIAL RECEIVED

No.....

Purchase Order No..... 19.....

Name.....

ARTICLE			COST			
LOT NO.	DESCRIPTION	QUANTITY	INVOICE	DISTRIBUTION CHARGES	TOTAL	RATE

CHARGES		OPERATING LEDGER			
DESCRIPTION	AMOUNT	ACCOUNT	COLUMN	FOLIO	AMOUNT

Received by..... Entered by.....

FIG. 11

A perpetual inventory of materials and supplies carried in stock may be obtained by the use of these forms; and this information may be recorded so as to show the articles on hand as to quantity only, or as to quantity and cost. The particulars contained on the form will be determined by the purpose for which the information is to be used. If a cost system is not in operation, and it is only desired to safeguard the stock and to assist the purchasing agent in buying, it will be necessary only to keep the record of stock in quantity, and the cost may be omitted. In either case, a separate card or sheet should be used for each article if the stock is active; but if it is inactive, and if the purchases are infrequent and the stock is used in large

STOCK CARD
RAW MATERIAL

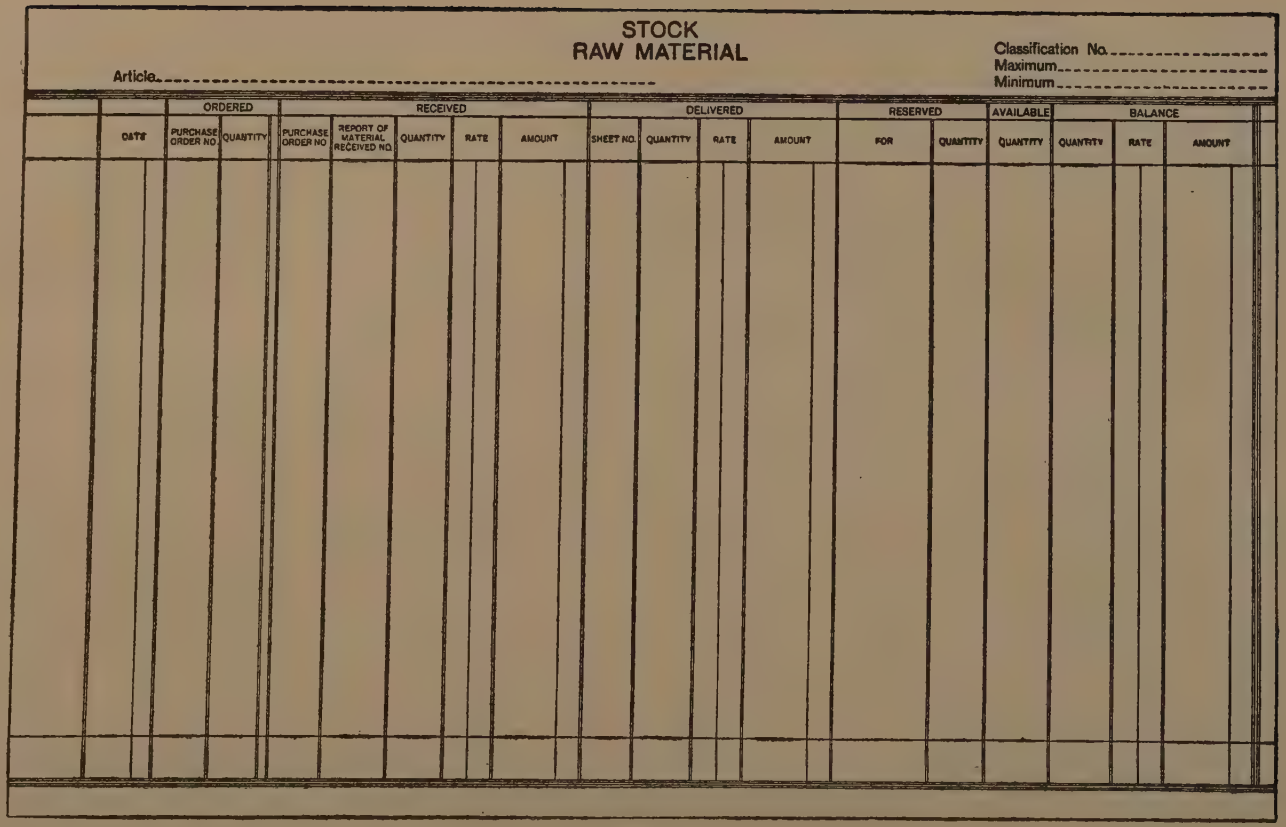
Classification No._____
Maximum_____
Minimum_____
Article_____ Pattern No._____ Location_____

RECEIVED			DELIVERED			BALANCE	
DATE	SHEET NO.	QUANTITY	DATE	SHEET NO.	QUANTITY	DATE	QUANTITY

Fig. 12

quantities, a record may be kept with all the articles listed on one or several sheets, with several blank lines left between articles.

At any particular inventory period, the stock records should be verified with the actual inventory. In the event of a discrepancy, whether overrun or shrinkage, the stock records should be changed to agree with the actual inventory, but not until the cause of such discrepancy has been ascertained. Unless the records are reconciled and compared with the actual inventory, and investigation made to ascertain the cause of the differences, the management cannot expect to have records that are worth the time and trouble involved in keeping them.



STOCK
RAW MATERIAL

Article.

Classification No.
Maximum
Minimum

	ORDERED			RECEIVED					DELIVERED				RESERVED		AVAILABLE	BALANCE		
	DATE	PURCHASE ORDER NO.	QUANTITY	PURCHASE ORDER NO	REPORT OF MATERIAL RECEIVED NO.	QUANTITY	RATE	AMOUNT	SHEET NO.	QUANTITY	RATE	AMOUNT	FOR	QUANTITY	QUANTITY	QUANTITY	RATE	AMOUNT

FIG. 13

FACTORY ORDER

No._____

To Foreman_____ Department Date_____

Charge all Material and Time to above Order No.

	DATE WANTED	PATTERN NO.	DRAWING NO.	DESCRIPTION	QUANTITY	

You are hereby authorized to manufacture the above articles as stated

Inspected by_____

Received_____ 19____

By_____ _____ Manager

FIG. 14

Original

PRODUCTION ORDER AND COST SHEET

_____ Department No._____ 19____

QUANTITY	DESCRIPTION	DIAGRAM

Date Wanted_____ 19____

Complete_____ 19____

Signed_____

You are hereby authorized to manufacture the above articles as stated

_____ (Superintendent)

FIG. 15

Duplicate

PRODUCTION ORDER AND COST SHEET

_____Department No._____ 19__

QUANTITY	DESCRIPTION	DIAGRAM

Date Wanted _____ 19_____

Complete _____ 19_____

Signed _____

You are hereby authorized to manufacture the above articles as stated

_____
(Superintendent)

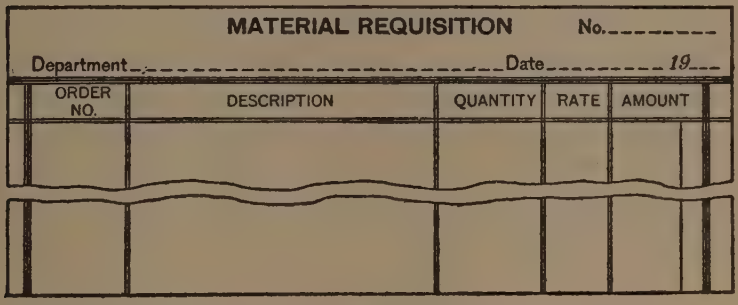
MATERIAL				LABOR					PATTERN		
QUAN.	DESCRIPTION	RATE	AMOUNT	DATE	WORKMAN	HRS.	RATE	AMOUNT	PARTICULARS	RATE	AMOUNT
									TOTAL		
									DRAWINGS		
Total Material Total Labor Total Pattern Total Drawing Indirect											
TOTAL COST				TOTAL LABOR					TOTAL		

FIG. 16

Factory or Production Order

The purpose of the factory or production order, of which Figs. 14, 15, and 16 are examples, is to substitute written instructions to the factory or manufacturing departments for verbal directions, and the forms may be used under certain conditions for cost-keeping purposes.

Whenever orders are issued covering a product that passes through several departments, some of which require different specifications, or whenever the work on the same order is being carried on in several departments simultaneously, *subproduction orders* may be issued to each department describing only the work to be done or the parts to be manufactured in that particular department. Otherwise, the same production order may be


MATERIAL REQUISITION No._____

Department_____Date_____ 19___

ORDER NO.	DESCRIPTION	QUANTITY	RATE	AMOUNT

FIG. 17

issued to all departments alike, by using a manifolding system and making as many copies as may be necessary.

The design of the form to be used will be determined by the conditions of manufacture. If it is desired to use the form purely for the purpose of regulating production, only the necessary explanatory matter need appear; but if, on the other hand, it is considered advisable to utilize a copy of the form for cost-keeping purposes, separate columns with the proper headings printed therein should be added and so arranged as to facilitate posting from employes' time reports and reports of material delivered. If it is desirable to keep the cost by operation, proper columns should be provided for each operation, and the form should be so ruled and designed as to enable the cost clerk to add overhead charges and ascertain the total cost of the order.

In issuing orders covering contract work or jobs that will involve large expenditures, it will be found of advantage to divide the order not only according to the department but also according to sections, and have the time reported by employes

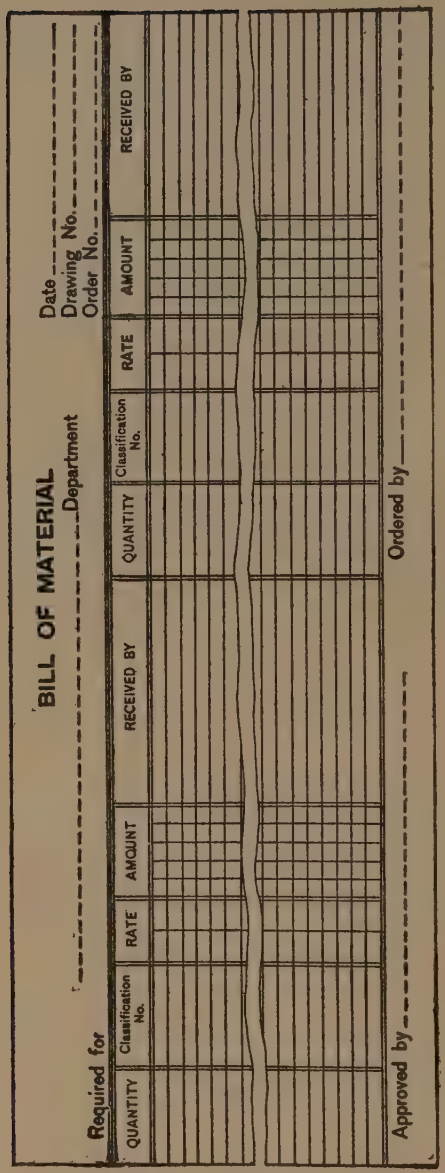


FIG. 18

in such a way as to show the time consumed in each particular department on each section or part of the work. The term "section," for example, in a contracting business would apply to foundations, walls, partitions, roofs, etc. This illustration is used not because this kind of form relates only to a contracting business, but because it is sufficiently general to illustrate the meaning of the term section to any one in any other line of business. If section numbers are used and carried through the cost keeping, it will be possible to compare the cost with the estimates and to follow the progress of the work in a more intelligent way than would be possible if the time were reported in total only and posted in one amount as labor on that particular order.

Material Requisition and Bill of Material

A material requisition, an example of which is illustrated in Fig. 17, merely calls for the article, and on it are given the order number, the description, the quantity, the rate, and the amount. It is to be used for taking all material or supplies out of stock in case a bill of material is not used. The mate-

rial requisition is made out by the department requiring the goods from stock to be put into process of manufacture. This kind of form is used in all manufacturing industries in which the business is more or less of a special-order one and the amount of material consumed on an order is subject to constant changes.

In manufacturing enterprises where the same article is made time and time again, consuming the same amount of material, it is not necessary to make out a material requisition every time an article is to be manufactured. In such cases, a bill of material (see Fig. 18) is used.

Inventory Test

The inventory-test form (see Fig. 19) is used to show the name of the article, the location, the actual count, the book

INVENTORY OF MATERIAL

Article_____ Location_____

Book Inventory_____ $_____

Actual Count_____ $_____

Difference_____ $_____

Cause_____

_____

Date taken_____ By_____

Fig. 19

inventory, the difference, the cause, and the date. This form is of great importance in connection with a cost system.

The method of procedure in making an inventory test is to send the form to the person in charge of the stock, writing the name of the article desired on the form and having the stockman enter the actual count and location of the stock. When the form is returned, the book inventory is inserted; and if the book records do not agree with the inventory taken, the difference should be indicated and the cause ascertained. Should there be an error that cannot possibly be located, it will be necessary under such circumstances to charge or to credit this difference, as the case may be, to general indirect expenses, or to Profit and Loss, depending on the circumstances.

TIME REPORTS

Principles Relating to Time Reports

Two methods of time reporting may be employed. In one use is made of mechanical devices, known as time clocks and time stamps, that register the time accurately on cards; and in the other, the time is reported in time books, on time sheets, or on time cards by an employe.

Time reports, or the forms on which the time is recorded, may be in the form of either a weekly or a daily report, and a separate report may, if required, be made out for each job or order, whether a fraction of an hour or days are consumed in completing the work. There are two principles to be considered in devising such time reports: (1) that of having a ticket show the time for one article, order, or process; and (2) that of having a ticket show all orders, articles, or processes engaged on during the day; or, a further distinction may be made as to the length of time the report is to be used, that is, whether for a day or for a week. If a time report is part of a cost system, and the time is not summarized on another sheet, the time reports should be provided with columns that show the amount of labor cost applying to each order number, article, or process.

The kind of time report to be devised will depend on the kind of cost system in operation, and should be based on one of two distinct principles. The first of these principles provides for charging the product manufactured and the second for charging the labor against a machine or a process and for ascertaining the cost per hour or per unit of operating the particular machine or process, which machine or process rate is then applied to the order or the product. The base of the charge may be either time or quantity, and the rate may be calculated according to the number of hours that the machine is in operation or to the number of units produced.

The following facts should be kept in mind in devising time reports. If the productive-labor method is used in the cost system and the costs for each order are to be obtained, the time reports should be so devised as to indicate the time chargeable to each order. If the costs for each order are not to be obtained as a whole, the time reports should provide for the charge against the article or the product chargeable. Wherever the principle involves machine or process cost, provided such a system is devised, the order number and the process or machine chargeable should be shown; if no order number is used, the form should be provided with a column that shows the name of the

article, as well as the machine number or process chargeable. The wage system in use should also be taken into consideration. If employes are engaged partly on day work and partly on piece work, the form should be devised so as to provide for both classes of work, although a separate form for day work and one for piece work may be used if desirable. Wherever the premium or the differential-rate system of wages is in use, the form should be devised with columns that indicate the data relative to the system in use.

Examples of Time Reports

Perhaps the simplest method of time reporting is that in which the workman makes out his own report on printed forms or blanks. Such forms may be arranged to show either day

TIME REPORT

Department ..... Date .....
Name ..... Clock No. .....
Occupation ..... Room .....

ORDER NO.	KIND	OPERATION	QUANTITY	TIME	RATE		AMOUNT	
Quantity O.K.		Price O.K.			Amount O.K.			

Fig. 20

work or piece work, or both, and also for either daily or weekly use. In all time reports in which only the wages of the workman are shown, the presumption is that the basis of the distribution of indirect expense will be on direct-labor cost.

In Fig. 20 is shown a daily time-report blank that may be used for either day-work or piece-work operators, and in Fig 21 is shown a daily report blank that is suitable for piece-work operators only, because it does not show the amount of time. Fig. 22 shows a daily-report blank that may be employed for reporting either day work or piece work, the same as the blank

shown in Fig. 20. It differs from the form in Fig. 20, however, in that it is so divided as to show the day rate and the piece rate in separate sections.

PIECE WORK REPORT

Department Date

Name Clock No.

Occupation Room

ORDER No.	KIND	OPERATION	QUANTITY	RATE	AMOUNT

Quantity O.K. Price O.K. Amount O.K.

FIG. 21

TIME REPORT

Name Department

Occupation Date

Clock No.

DAY WORK

ORDER NO.	KIND	OPERATION	TIME	RATE	AMOUNT

PIECE WORK

ORDER NO.	KIND	OPERATION	QUANTITY	RATE	AMOUNT

Quantity O.K. Price O.K. Amount O.K.

FIG. 22

Fig. 23 shows a weekly time-report blank to be kept by the workman. This blank, as will be observed, is the same as

TIME REPORT

Name _____ Department _____ Week Ending _____

Occupation _____ Clock No. _____

DAY WORK

ORDER NO.	KIND	OPERATION	MON.	TUES.	WED.	THUR.	FRI.	SAT.	TOTAL	RATE	AMOUNT

PIECE WORK

ORDER NO.	KIND	OPERATION	MON.	TUES.	WED.	THUR.	FRI.	SAT.	TOTAL	RATE	AMOUNT

Quantity O.K. Price O.K. Amount O.K.

FIG. 23

TIME REPORT

Week ending

Department ____ 19____

Name ____ Clock No. ____

Occupation ____ Machine No. ____ Operation ____

DESCRIPTION OF WORK	MON.	TUES.	WED.	THUR.	FRI.	SAT.	TOTAL	RATE		AMOUNT	
Production											
Hours											
Production											
Hours											
Production											
Hours											
Production											
Hours											
Production											
Hours											
Production											
Hours											
Production											
Hours											

Quantity O. K. ____ Price O. K. ____ Amount O. K. ____

FIG. 24

TIME REPORT

Name ..... Department ..... Date .....
Occupation ..... Clock No. .....

PRODUCTION						TIME			COST	
ORDER No.	ARTICLE	OPERATION	MADE	DEFECTIVE	GOOD	BEGUN	FINISHED	HOURS	RATE	AMOUNT

Approved: ..... Correct: .....

FIG. 25

TIME REPORT

..... Department.
Name ..... Week ending ..... 19.....
Occupation .....

PRODUCTION					TIME				CHARGE	
DATE	ARTICLE	MADE	DEFECTIVE	GOOD	BEGUN	FINISHED	HOURS	ORDER No.	MACHINE No.	PROCESS

..... Correct: .....

FIG. 26

that shown in Fig. 22, except that it provides for 1 week instead of 1 day.

Fig. 24 shows a weekly time-report blank that is somewhat similar to the one shown in Fig. 23, inasmuch as it would show, when properly filled in, both day work and piece work for a week, provided in both cases that the operator is working on one class of work for which the rate for the whole week is uniform. The main feature of this form of report is that the hours on the production are stated, thus permitting it to be used in connection with the distribution of indirect expenses on the direct-labor hours and on the machine-rate method. It is intended to be used, however, in cases where an operator is work-

THIS SIDE OUT
No. 275
NAME

Fig. 27

WEEK ENDING ..... 193...
No. 275
NAME

DAY	MORNING		AFTERNOON		OVERTIME		TOTAL
	IN	OUT	IN	OUT	IN	OUT	
MON.	≥ 6 50	≥ 12 02	≥ 1 30	≥ 6 03			
TUE.	≥ 7 01	≥ 12 13	≥ 12 45	≥ 6 01			
WED.	≥ 6 45	≥ 12 05	≥ 1 01	≥ 6 00	≥ 7 00	≥ 10 05	
THU.	≥ 6 55	≥ 12 01	≥ 12 50	≥ 6 05			
FRI.	≥ 9 30	≥ 12 00	≥ 12 58	≥ 6 10			
SAT	SA 6 40	SA 10 45	SA 12 59	SA 5 59			
SUN.							

TOTAL TIME ..... HRS.
RATE .....
TOTAL WAGES FOR WEEK .....

Fig. 28

ing for 1 week on one machine. As will be observed, the forms shown in Figs. 20 to 23 are designed to carry out the charge against orders that would represent a special-order system; whereas, the form shown in Fig. 24, inasmuch as it does not contain the order number, is intended to be used where the process or the product cost system is in operation.

Fig. 25 illustrates a daily time-record blank that is designed to show the quantity of production, the time, and the cost. The distinctive feature of this report, differing from those described previously, is that provision is made to show the class of production. All time reports in which a column is provided for the order number would indicate that a number of different order

numbers may be worked on in the course of a day by a workman. If the order number is placed at the head of the report and no column is provided, it would indicate that only one order number could be used on that particular form.

The blank shown in Fig. 26 belongs to the same class as the one shown in Fig. 24. However, it may be used for a special-order system. It is ruled the same as the blank in Fig. 25, with the exception that the three columns at the right show the disposition of the charge. This style of form is employed where different cost-finding methods are in use in one plant; that is, the cost by order, by machine, or by process may be obtained from this one form.

OPERATOR No.		PIECE No.			ORDER No.		
MAKE		DATE FINISHED					
DESCRIPTION OF JOB							
DAY	ON	OFF	HRS.	RATE	DOLS.	CTS.	
WED.							
THU.							
FRI.							
SAT.							
SUN.							
MON.							
TUE.							
ENTERED ON COST CARD							
COUNTED AND APPROVED BY INSPECTOR							

	1	2	3	4	5	6	7	8	9	0
THOUSAND										
HUNDRED										
TEN										
UNIT										

FIG. 29

Figs. 27 and 28 illustrate the front and the back, respectively, of an ordinary form used in a clock register, the back showing, in the proper spaces, the entering and leaving time of the employe, as registered by punching the clock. This form may be used as an organization form or as the report of non-productive workmen; it is, of course, of no value for making direct labor charges against either article or product.

Fig. 29 shows a form, or blank, used in a special-order system. On this report the production is stated as a whole for the week and checked by an inspector.

In Fig. 30 is shown an ordinary form that is employed where the machine is the basis of the cost finding and where a premium system is in use. The particular specifications on this form provide for the day-work rate, the premium allowed, and the piece-work rate, as well as the drawing number and the factory order number.

In Fig. 31 is shown a form that is used in a special-order

cost system in which a time-stamp device is in use. This particular form represents a machine-shop record. At the top of the form, to the right, it shows the date, the job number, the work-

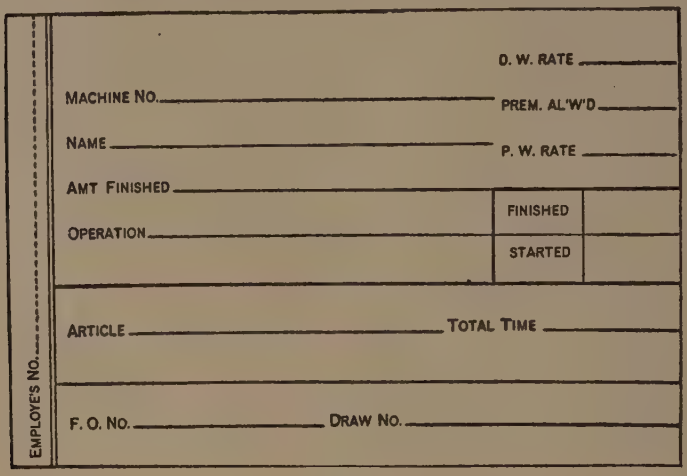


FIG. 30

man's number. At the left it shows the time that work is commenced and the time that is employed on a single operation, all of the operations being printed on the card. Only one card can be used on a single operation, for which reason it is used

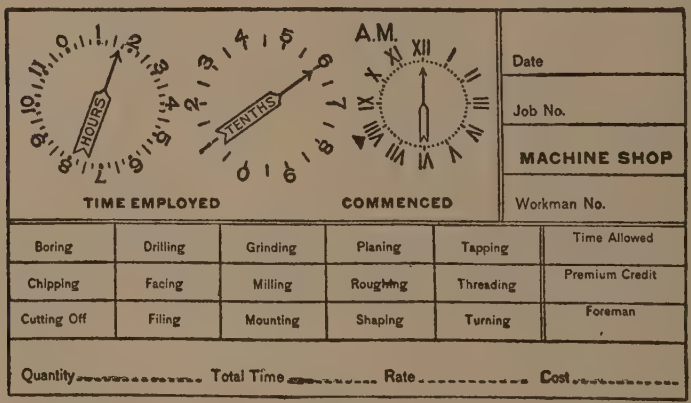


FIG. 31

in plants where, in most cases, the workmen are employed on a single operation during the whole day. The object of printing all the operations on this one form is to provide a uniform card

TIME CARD

P. R._____ D. R._____

Clock No._____ Date_____

Name_____ Dept._____

Time		Order No.	Oper. No.	Production			Rate	Amount	√
Units	H. & M.			Total	Def.	Good			
	7:00								
1	05								
2	10								
3	15								
4	20								
5	25								
6	30								
7	35								
8	40								
9	45								
10	50								
11	55								
12	8:00								
13	05								
14	10								
15	15								
16	20								
17	25								
18	30								
19	35								
20	40								
21	45								
22	50								
23	55								
24	9:00								
25	05								
26	10								
27	15								
28	20								
29	25								
30	30								
31	35								
32	40								
33	45								
34	50								
35	55								
36	10:00								
37	05								
38	10								
39	15								
40	20								
41	25								
42	30								
43	35								
44	40								
45	45								
46	50								
47	55								
48	11:00								
49	05								
50	10								
51	15								
52	20								
53	25								
54	30								
55	35								
56	40								
57	45								
58	50								
59	55								
60	12:00								
		Totals							

NOTE.—When job is complete, check thus: √ in last column.

O. K._____ Inspector. O. K._____ Foreman.

FIG. 32

for all workmen, each workman being obliged to check the operation upon which he is employed during the day. This style of form, or blank, may also be used where a premium system is in use.

Fig. 32 shows one side of a report blank that is designed for use with a special-order system that is based on what is known as the *unit plan* of time recording. The hour is divided into twelve units of 5 minutes each, and when computing time units are considered instead of hours and minutes. For use in connection with this time report, tables having the values of any number of units worked out for the various rates per hour, per week, or per day, are prepared in advance. The several headings on this time card, with perhaps the exception of P. R. and D. R., are self-explanatory; P. R. and D. R. indicate whether operatives are employed on piece work or on day work. Time is recorded by merely drawing a line through the nearest unit of time when beginning and stopping work on a job. One card serves for a full working day and may be designed to cover overtime as well. It is printed on two sides—one for morning, the other for afternoon. Units for morning run consecutively from 1 to 60, beginning at 7:05 and ending at 12 o'clock. For afternoon, units begin with 61 at 1:05 and end with 120 at 6 o'clock. The number of units and the time to be shown are regulated according to working time in each plant. It is of no consequence, so far as the operating plan is concerned, whether the hour is divided into units of 5, 6, 10, or 15 minutes.

COMPILATION AND DISTRIBUTION OF COST DATA

General Procedure

The lapse of time that is used as a basis for the entering of all cost calculations upon the cost records is known as the *cost period.* It may be a period of 4 or 5 weeks or it may be the regular calendar month, depending on the conditions of the plant in question. If the employes are paid weekly, it is much easier to use a period of 4 or 5 weeks as a basis than to use the regular calendar month and calculate accruals for the few extra days in the month for that part of the wages which is still unpaid. On the other hand, if the employes of the factory are paid monthly or twice a month the regular calendar month may be used as the basis for the cost period.

After having decided on a cost period, the compilation of the *elements of cost,* namely, material, labor, and indirect expenses, should receive attention.

In the designing of forms for the compilation of the details of cost, the first and most important point to be determined is the basis of cost finding; that is, whether the cost of each production order is to be obtained or only the cost of all articles of a similar description. In many instances, a factory order is issued for goods that are manufactured continuously, and the cost of this order is ascertained separately. This policy is good when practicable, as in this way results are obtained that could not be accomplished if the cost of the article were figured separately from the orders issued.

Any complete cost system falls within four general classes. It may be:

(1) A special-order system based on productive labor; (2) a special-order system based on process or machine costs; (3) a product system based on productive labor; or (4) a product system based on process or machine cost.

The set of forms used will, of course, depend on which of the four classes is chosen as best adapted to the conditions at hand.

The first step in the compilation and distribution of cost data is to review both the various entries that form necessary parts of a cost record and the sources from which they are obtained. The entries themselves may be posted to a cost journal and from there classified and entered into the operating ledger, or they may be transferred directly to the operating ledger from summarizing sheets; for example, the pay roll or many accounts may be entered directly from the original records. As far as possible, the nature of the whole system should be such that it will admit of easy reference; also, there should be a system of checks between the different parts so as to avoid errors or to detect them quickly when they do occur.

It must be kept in mind that these entries record only the transactions that enter into cost records as such.

HANDLING COST ELEMENTS

Material

When material is received, the receiving clerk, after inspecting and counting the goods received, makes out a material-received sheet, which gives rise to the first entry, namely, a *debit* to material or supplies and a *credit* to the creditor or cash. This entry, for the charges to the stock records of raw materials and supplies, may be made by means of the accounts-payable

REPORT OF MATERIAL DELIVERED

For the Month of ---------- 19---

	CLASSIFICATION No.	ORDER No.	DEPARTMENT	ARTICLE	QUANTITY	RATE	AMOUNT	TOTAL

FIG. 33

voucher, which is entered in the accounts-payable voucher record or register of accounts payable in connection with the material-received sheet.

Summary of Material Requisition

After having decided on a method of recording the receipts of raw material and supplies, the next step is to consider the entries for the deliveries to the various operating departments. These entries embody a *debit* to the operating department, the job, the order, or the article, depending on the method of the cost-keeping system in use, and a *credit* to the raw-material stock.

As in the case of the raw material received, these entries may be made daily, weekly, or monthly. When they are made weekly or monthly, a summary of material requisition or bills of material (Fig. 33) may be used, and in that case the material requisition would be attached to the summary sheet for the purpose of filing these records.

Labor

When the wages of the operators are paid, the entry would embody a *debit* to wages or pay-roll account and a *credit* to cash.

In order to distribute the wages, the time reports should be summarized upon a pay-roll summary. This pay-roll summary, besides showing the total amount of wages, shows also the amount due each employe and may be used for pay-roll purposes.

The entries for the distribution would embody a *debit* to the order, the job, the article, or the department for the productive labor, that is, labor that is chargeable directly; a *debit* to the overhead expense for the non-productive labor, that is, labor that cannot be charged directly to any special order, job, article, or department; and a *credit* to the pay-roll account for the total amount of wages distributed.

Pay-Roll Forms

To understand this matter clearly, reference should be made to the following forms:

Fig. 34 illustrates a form on which the time records may be entered after being summarized for pay-roll purposes and also for the distribution of the labor according to department and according to direct, indirect, supervision, power, and maintenance distribution.

Fig. 35 illustrates a form on which may be summarized the time records for charging direct labor to the order, the job num-

FACTORY PAY ROLL For Week ending 19

EMPLOYE						DISTRIBUTION				
DEPT.	CLOCK No.	NAME	RATE	TIME	AMOUNT	DIRECT	INDIRECT	SUPERVISION	POWER	MAINTENANCE

PAY ROLL

Clock No. _____

Name _____ Department _____ Rate _____

DATE		Order, Job No., or Process	ARTICLE	OPERATION	MADE	DEFECTIVE	GOOD	TIME	RATE	AMOUNT

FIG. 35

ber, or the process. A form of this kind may be used for summarizing the direct labor according to each individual workman; or, the name of the workman may be omitted on the form used for summarizing the cost on the order, independent of the individuality of the workman.

Indirect Expenses

When overhead expenses are incurred, a *debit* is made either to the indirect-expense account or various expense accounts representing the different classifications of indirect expenses, and a *credit* is made either to cash or to the creditor.

The next step is to distribute these overhead expenses over the various orders, the job, the operating department, or the

Department No. 1	$803.67	
Department No. 2	58.58	
Department No. 3	274.16	
Department No. 4	573.59	
Department No. 5	218.73	
Department No. 6	82.54	
Department No. 7	175.98	
Superintendent		$184.32
General labor		967.19
Light, heat, and power		136.23
Insurance		375.14
Taxes		245.83
Freight, express, and cartage		109.45
Factory supplies		16.21
Salaries of factory-office clerks		115.00
Factory-office supplies		10.72
Incidentals		27.16

FIG. 36

machines. An entry distributing general operating expenses of $2,187.25 might be as shown in Fig. 36.

Production

The recording of the production of various operating departments and of the plant as a whole is a very important link of a complete cost-accounting system. The production report, besides being used as a record for cost entries, serves as a basis for comparing and judging the efficiency of the various operating departments and also brings before the management the daily and weekly output of the plant.

The reports may be designed so as to be used for the purpose of posting the credits to the stock records or cost records, as well as for posting the charge to the operating departments to which the goods are transferred to the partly finished or the finished-stock accounts.

Fig. 37 shows a simple form of production report. It is meant to show only the quantities produced, and is generally used for the purpose of checking up piece work and keeping a record of stock.

PRODUCTION REPORT No._____

_____ Department Date_____ 19__

PRODUCTION			QUANTITY		
ORDER NO.	ARTICLE	OPERATION	MADE	DEFECTIVE	GOOD

Received by: _____ Correct: _____

FIG. 37

Fig. 38 shows a production-report form that has provisions for the quantity, rate, and amount of the production; also, it

PRODUCTION REPORT No._____

_____ Department

Date_____

PRODUCTION				COST			
ARTICLE	QUANTITY	RATE	AMOUNT	DESCRIPTION	QUANTITY	RATE	AMOUNT
				Material:			

Approved: _____ Correct: _____

FIG. 38

provides for showing the material cost that has gone into the making of the article.

Fig. 39 shows a form in which may be recorded the cost of the previous operations, the cost of material, labor, and indirect

SUMMARY OF PRODUCTIONS & COSTS

_____ Operation Week ending_____ 19___

ARTICLE	PRODUCTION							COST													
	M	T	W	T	F	S	TOTAL	PREVIOUS OPERATIONS		MATERIAL		LABOR		INDIRECT				TOTAL	
								RATE	AMOUNT	RATE	AMOUNT	RATE	AMOUNT	%	AMOUNT			RATE	AMOUNT

FIG. 39

expenses consumed in the local department, and the total cost of all operations up to and including the department in which the report is made out. If the article is transferred to another operating department, an entry would credit the one operating department and charge the other with the accumulated cost to date. However, if the article were completed, the entry would be a *charge* to finished stock (or it might be partly fin-

PRODUCTION REPORT
BRASS FOUNDRY

No._____
Date_____

METAL	QUANTITY	RATE	AMOUNT	LABOR	TIME	RATE	AMOUNT
SUNDRIES				FUEL			

COST OF MELT	RESULT OF MELT
Metal, $_____	Good Castings, Quantity_____ Rate_____ Amount_____
Labor, _____	Defective " _____ " _____ " _____
Fuel, _____	Scrap " _____ " _____ " _____
Sundries, _____	Waste " _____ " _____ " _____
Total, $_____	

Approved: _____ Cost Clerk

Correct: _____ Foreman

FIG. 40

ished stock if the article were transferred to stock in a partly finished condition) and a *credit* to the operating department.

Fig. 40 illustrates the style of production reports used in a brass foundry.

All the forms shown here are used only for illustrating the principle, and there are many cases where forms of an entirely different character will have to be made to meet the individual needs of the plant. The form shown in Fig. 40 is used here to illustrate this point, as well as to show how different this form of production report is from the preceding ones.

DEFECTIVE WORK REPORT

_____ Department For _____ 19___

	ARTICLE	DEFECT	CAUSE	DISPOSITION	QUANTITY	RATE	AMOUNT

Approved: _____ Correct: _____

FIG. 41

Defective Work

The forms illustrated in Figs. 37 and 38 are used also for showing the defective work produced.

The defective-work report shown in Fig. 41 is important and will, in most cases, result in a saving to the business where it is used, as the majority of foremen and superintendents are not desirous of having frequent reports of this character made.

A defective product is worthless from a cost-finding standpoint and may be disposed of in one of the following ways: It may be charged directly against the order or article; or it may

STOCK CARD
FINISHED PRODUCT

Class No.....
Maximum.....
Article..... Minimum.....

DATE		PRODUCTION		SHIPMENTS		BALANCE
		REPORT NO.	QUANTITY	REPORT NO.	QUANTITY	QUANTITY

Fig. 42

be charged to a defective-work account, which is included in the general expenses of the business.

However, if the material is reclaimed, it should be taken into stock at a reduced rate, and the difference between the cost and the reduced rate should be charged in the manner just stated.

Stock Records of Finished and Partly Finished Stock

All remarks regarding the raw-material stock records necessarily apply to the records of finished stock and partly finished stock, as both are for the purpose of keeping track of stock and regulating production.

A stock card is shown in Fig. 42. It shows quantities only, its main purpose being to keep track of the stock on hand.

Fig. 43 illustrates a stock card that shows the quantity, the

rate, and the cost value of the stock produced, of the shipments, and of the balance.

Fig. 44 shows a form designed for the purpose of recording all the preceding information. The production would be obtained from the production reports or cost sheet, depending on the method in use; the sales or shipments could be taken from the sales sheet, or sales book, or from a copy of the shipping order; the orders received and canceled can be taken from the customer's original orders or from correspondence; the unfilled orders, of course, represent the difference between the

STOCK CARD

FINISHED PRODUCT

Classification No._____

Maximum_____

Article_____ Minimum_____

DATE		PRODUCTION			SHIPMENTS			BALANCE		
		QUANTITY	RATE	AMOUNT	QUANTITY	RATE	AMOUNT	QUANTITY	RATE	AMOUNT

Fig. 43

total orders received, less the canceled orders, and the total shipments. The balance of stock on hand consists of the difference between the production and sales columns. The gross profit is ascertained by deducting the cost of the goods sold from the selling price.

SUMMARIZING ENTRIES INTO ACCOUNTS

Operating Ledger

The operating, or factory ledger is that book in cost accounting which arranges and classifies the detailed entries that have been made upon the original records.

The accounts generally kept in the operating ledger are: (1) Raw-material-and-supplies account; (2) labor account; (3) indirect-expense account; (4) accounts for the various orders or jobs; (5) accounts for the various operating departments;

Stock
Finished Product

Sheet No. _____
Maximum _____
Minimum _____

Article _____

	PRODUCTION				ORDERS		SALES				COST OF SALES		GROSS PROFIT		UNFILLED	BALANCE		
Date	Report No.	Quantity	Rate	Cost	Received	Cancelled	Sheet No.	Quantity	Rate	Amount	Rate	Amount	Amount	Rate per.....	Orders	Quantity	Rate	Amount

FIG. 44

(6) partly finished-stock account; (7) finished-stock account; and (8) general or private ledger account.

The *ruling* of the operating ledger may be similar to the ordinary ledger ruling; that is, a column for the date, the explanation, the reference, and the amount on both the debit and credit sides. However, it may be well to have distinctive rulings for the various accounts. For example, while the ordinary ledger ruling would answer for the accounts of raw material and partly finished and finished stock, the order or job and department accounts would be ruled in the manner shown in Fig. 45; also, the labor and overhead-expense accounts might be ruled

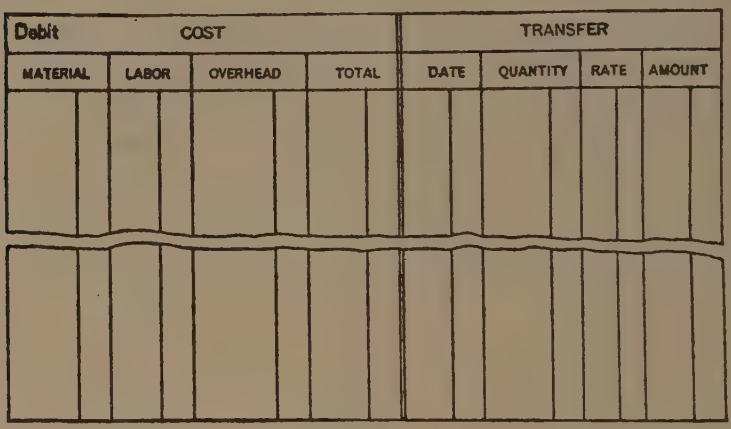


Fig. 45

according to the ordinary ledger ruling, and the analysis of these accounts may be upon a form similar to that shown in Fig. 46.

Raw-Material-and-Supplies Account

The raw-material-and-supplies account shows in total what is shown in detail by the raw-material stock records. The account is debited with all the material and supplies received, and is credited with any material and supplies returned and with all the deliveries to the operating departments. The entries may be in detail or in total, depending entirely on the system in use. The balance at the end of a cost period should equal the total of the balances shown by the raw-material stock records.

Labor Account

The labor account is debited with the amount of the pay roll and is credited with its distribution to the various order, or

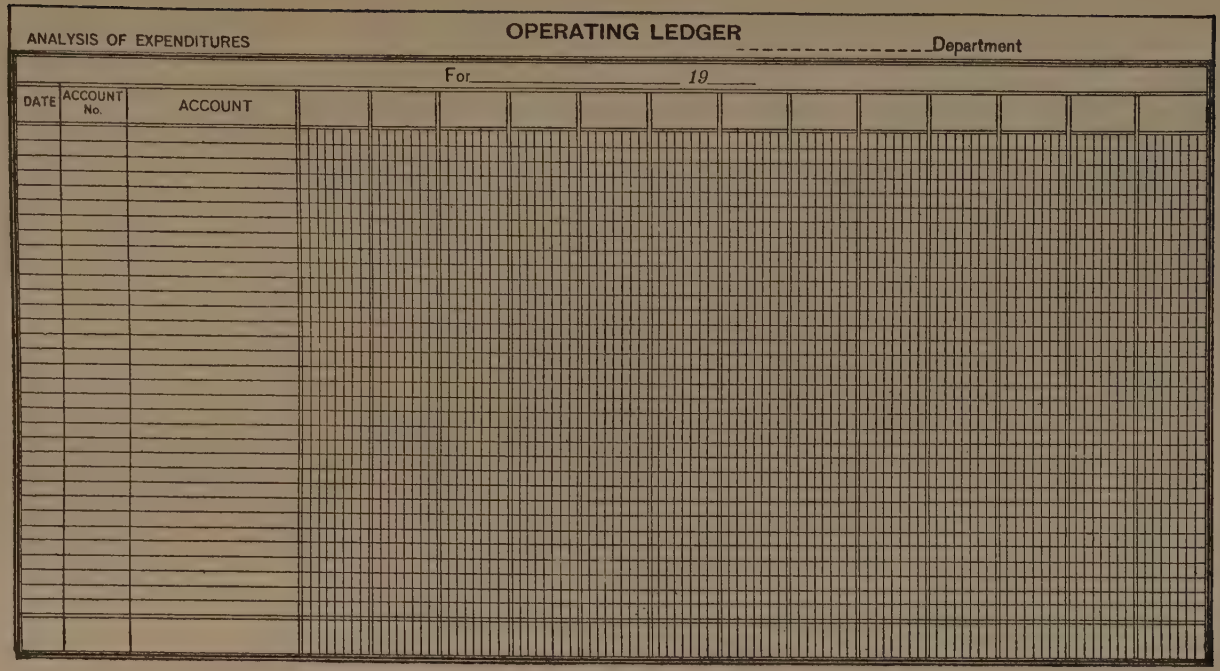

ANALYSIS OF EXPENDITURES
OPERATING LEDGER
Department
For
19
DATE
ACCOUNT No.
ACCOUNT

FIG. 46

job, numbers or operating departments, depending on the system in use.

Miscellaneous Accounts

The indirect-expense account shows on the debit side the amount incurred for overhead expenses and is credited with the distribution of the same. The balance, if any, would be a debit that would show the amount of expenses incurred that have not been distributed. At the end of the cost period it can be analyzed upon a form similar to that shown in Fig. 46.

The special-order account is debited with the elements of cost, material, labor, and indirect expense, and is credited when the job is completed with the total cost. The balance, if any, is always a debit and shows the cost value of the jobs in their uncompleted state.

The operating-department accounts are debited with the total cost, if any, incurred in previous operating departments, as well as with the material and labor consumed in the operating department in question, the amount of the department expenses, and a per cent. of the total indirect expenses. They are credited with the total accumulated cost when the job is transferred to the next operating department or to partly finished stock or finished stock. The balance, if any, is a debit, and represents the cost value of the work in process in that department.

The partly finished-stock account is debited with the cost of the partly finished stock, and is credited with the cost of that part which is either put into process for the purpose of completion or which is sold. The balance, if any, is a debit and shows the cost value of the partly finished goods on hand. This account shows in total what is shown in detail by the partly finished-stock records, and the total of the balances as shown by the partly finished-stock records should agree with the balance shown by the partly finished-stock account.

The account for finished stock is debited with the cost of the goods that have been finished, together with the cost of the returns to stock by customers, and is credited with the cost of the goods sold. The balance, if any, is a debit and shows in total the cost value of the stock on hand. The finished-stock records show in detail what is shown by the finished-stock account in total, and, as in the case of the stock records previously mentioned, the balance as shown by the finished-stock account should agree with the total of the balances shown by the finished-stock records.

The general- or private-ledger account is the balancing account of the operating ledger and is also the connecting link

	Date		Folio	Debit	Credit
Entry No. 1		Raw Material and Supplies: To (Creditor or Cash) General-Ledger Account. For the total amount of purchases received during the period.			
Entry No. 2		Labor: To (Cash) General-Ledger Account. For the amount of wages paid during the period.			
Entry No. 3		Overhead Expenses: To (Cash or Credit) General-Ledger Account. For the amount of overhead expenses incurred during the period.			
Entry No. 4		Job, Order, Article, or Department: To Raw Material and Supplies. For the amount of material requisitions during the period.			
Entry No. 5		Job, Order, Article, or Department (Direct Labor): Overhead Expenses (Non-Productive Labor). To Labor: For the amount of wages distributed during the period.			
Entry No. 6		Job, Order, Article, or Department: To Overhead Expenses: For the amount of overhead expenses distributed during the period.			
Entry No. 7		Partly Finished Stock or Finished Stock: To Job, Order, Article, or Department. For the amount of work finished and placed into stock during the period.			
Entry No. 8		(Cost of Sales) General Ledger: To Finished Stock. For cost of goods sold during the period.			

Fig. 47

between the cost records and the financial records. By means of this account, a trial balance of the operating ledger can be taken off. It is credited with the amount of material, the labor, and the indirect expense, which elements are debited to their respective accounts, and is debited with the cost of goods sold, which cost is credited to the finished-stock account; the balance is a credit and agrees with the debit balance of the operating-ledger account in the financial books.

Cost Journal

The cost journal, Fig. 47, is generally designed similar to the ordinary two-column journal; that is, it has a column providing for the date, a wide column for the explanation, a nar-

	Date		Folio	Debit	Credit
Entry No. 9		Job, Order, Article, or Department: To Raw Material and Supplies, Labor, Overhead Expenses. For the amount of material requisitions and the amount of labor and overhead expenses distributed during the period.			

Fig. 48

row reference (folio) column, and two money columns, one for debits and the other for credits.

The cost journal is not used in every system of cost accounting as a posting medium for the operating ledger, as the infor-

	Date		Folio	Debit	Credit
Entry No. 10		Job, Article, Order or Department: To Partly Finished Stock. Amount of partly finished stock put into operation for the purpose of being completed.			

Fig. 49

mation that would generally go into it may be had directly from the other records.

Assuming that the cost journal were in use, the entries shown in Fig. 47 would go into the journal.

Entries Nos. 4, 5, and 6, Fig. 47, may be combined into one entry, in which case they would read as shown in Fig. 48.

If partly finished stock (see entry No. 7, Fig. 47) were put into operation again, to be completed, the entry would be as shown in Fig. 49.

The ten entries shown in Figs. 47, 48, and 49 illustrate the various steps in a cost system and follow the raw material through the various operations until it becomes a finished product and is placed on sale.

The records from which the preceding entries could be posted directly into the operating ledger if the cost journal were not in use are as follows:

Entry No. 1: Cash book; accounts-payable voucher; register of accounts payable; summary of material received.

Entry No. 2: Cash book; pay-roll book or summary.

Entry No. 3: Cash book; accounts-payable voucher; register of accounts payable.

Entry No. 4: Material requisition or bill of material; summary of material requisition or bills of material; production report.

Entry No. 5: Pay-roll summary; production report.

Entry No. 6: Statement of factory expenditures; production report.

Entry No. 7: Production report.

Entry No. 8: Shipping order; register of sales and cost on sales book.

Entry No. 9: The combination of entries Nos. 4, 5, and 6.

Entry No. 10: Summary of requisitions for partly finished stock.

GENERAL INTRODUCTION TO SYSTEMS

Principles and Methods

In presenting the following graded set of cost systems, use is made of only those principles and forms which have been in actual operation in either large or small factories, or in both; therefore, these systems, as well as the forms appearing in connection with them, do not in any case represent what might be done, but, rather, what has actually been accomplished.

Many of the forms of the same class appear to be alike, with slight changes in the ruling or arrangement. These small differences are not always of importance and are used purposely to suggest how to effect changes in detail; but a careful scrutiny will show that in most cases the differences are more material

than they appear to be on the face. The object in view is to cultivate the ability to choose or to design forms that will be adaptable to the line of business and the particular conditions of manufacture that are under consideration.

One of the common mistakes made by business men who attempt to design a cost system without the assistance of a technical man or an experienced systematizer is to produce a form so specific as to admit of no change whatever. In such cases, a small omission here or there makes it impossible to use the form; whereas, if the form were general in character, the difficulty would disappear. Such forms are usually so arranged as to obtain information for one particular purpose only, and for this reason it is impossible to use them in the compilation of general results, or to utilize the information furnished for any further purpose.

It should be borne in mind that information on one particular subject cannot be gathered without at the same time procuring information that can be utilized in other ways. As an illustration, it would not be possible to obtain a list of the material used in manufacturing, chargeable to a particular order or product, without at the same time gathering information of use in running a stock system; and this same principle holds true in compiling any and all information relating to cost accounting.

Although the average public accountant cannot possibly design and install factory systems purely from accounting principles, the manufacturer, on the other hand, cannot, with the knowledge of manufacturing only, devise a satisfactory system. He must, in addition, possess the technical knowledge of the public accountant as to underlying principles. This fact, it might be stated, explains why the accountant is so often unsuccessful in installing systems, and also accounts for the failure of the manufacturer in his own efforts to obtain reliable results along these lines. Neither understands the difficulties to be encountered.

It is important then for the systematizer to know both theory and practice. To be able to apply his principles in a manner that will provide for the results without interfering with production, or seeking to obtain information in a way that is wholly impracticable, the systematizer must know the principles and practice of accountancy thoroughly, and must be familiar with the conditions of manufacture and the difficulties involved.

In order to assist those who, instead of using an actual cost system, estimate their costs and keep their general accounts in the books in such a way as not to know how accurate these

estimates are, certain methods of verification are described under the heading Primary Cost System.

These methods are presented with the idea of enabling a manufacturer to satisfy himself as to the accurateness of his estimates, and to see whether the discrepancies in the estimates are of such a nature or of such an extent as to cause alarm. The principles involving the verification of estimated costs are explained by illustrating the most simple method of ascertaining the facts, consistent with accuracy; and from this simple method, using the same principles, two more extensive plans are described, these three methods being calculated to outline in what ways the inaccuracies occur.

After all the facts have been determined and it is known wherein the estimated costs are incorrect, then it must be decided what action should be taken. Attention is called to the fact that if these estimates are at fault in estimating material costs, and an investigation reveals the fact that these estimates cannot be more carefully calculated by the existing methods, a stock system should be installed. If, on the other hand, the results show that the difficulty lies in labor estimates in any one department, then a cost system should be installed in that particular department. In the event that all the results are shown to be unreliable, a complete cost system should be installed in all departments, to be operated for a certain period of time, at least, so as to obtain the information that will make it possible to revise estimates and to make such changes in selling prices and in manufacturing methods as the case requires.

The primary cost methods are not cost systems in the true sense, because they do not provide for finding the cost of any order, article, or class of articles. The best that can be had from them is a verification of the estimated costs in a lump sum for each element, material, labor, and overhead.

The *departmental cost system,* which is described later, forms an intermediate step between the verification of estimates and a complete cost system. The purpose of this system is to determine the cost of manufacture of general classes of product, though not of the unit order or article. Therefore, it must be kept in mind that the word *department* as here used has no reference to operating departments, but means the classification of product; that is, each kind or class of product is considered as a department in the accounts.

The advantages of a departmental cost system are that much of the detail work necessary in an actual cost system is avoided, and that the results give true costs as far as they go.

The great disadvantage of such a system is that much information relative to particular articles is hidden in the generality of results, which means that some articles of a class may be made at a gain and others at a loss without the management knowing the difference. In such cases, the losses on one set of articles must be paid out of the profits on the other classes, the results showing only the general profit or loss on the whole.

However, one of the objects of trying a departmental system is to find out whether a more detailed system is necessary. When certain departments show a profit and other departments a loss, a detailed cost system should be inaugurated at least in those showing the loss, which may extend in time to all the departments of the factory.

It should not be inferred from the foregoing remarks that a *complete cost system* is more or less undesirable if the more elementary systems seem to work out well. No matter what the returns in the elementary systems may be, the saving and increased profit coming from a complete system will justify a liberal expenditure in that direction.

The importance of this subject is generally conceded, but at the same time actual cost work is much neglected. The only explanation is that either the business man and his assistants are not able to inaugurate such a system, or the expense that might be involved prevents them from taking any action in this direction. Experience has clearly shown that where an actual cost system is properly designed and installed, and where the information furnished is intelligently used in connection with both the sales department and the factory, the installation is wholly justified by the results. The expense of installing and keeping such records is so small in comparison with the saving as to be an unimportant factor, when the net results derived are taken into consideration.

Under the subject of compilation of cost data, attention is called to the four general types under which all complete cost systems must be classified; namely, (1) a special-order system based on productive labor; (2) a special-order system based on process or machine costs; (3) a product system based on productive labor; and (4) a product system based on process or machine costs.

Later each general type of system is described and suitable forms are suggested. The importance of thoroughly understanding the principles and conditions of these systems cannot be overestimated, and all the forms shown should be studied so as to give a knowledge of how to apply the principles from a

system standpoint to the conditions existing in any particular business.

It will be observed that only two methods of distributing indirect expenses are used in illustrating the systems. This is done so as to show clearly the essential differences between the four complete cost systems without causing confusion by the explanation of a different method of distributing indirect expenses in each case. For instance, the first two systems relate to a business in which the product is manufactured on special orders only, and in which it is desirable to obtain the cost on each order. In the first of these systems, the indirect expenses are distributed on the productive-labor method, and in the second on the new-machine-rate plan. The last two systems relate to a business in which product costs are desirable, and the same two methods of distributing indirect expenses are used in the systems so as to make the comparison marked and distinct. Other methods of distributing indirect expenses may be applied according to the conditions of manufacture.

Procedure in Examining a Plant and Installing a Cost System

The most important and essential requirements in cost finding, after a knowledge of principles and methods, is skill in the application of them to particular manufacturing conditions. After what has been stated about this subject, it must appear that the successful cost accountant or cost clerk or manufacturer who introduces a practical, workable cost system must have ingenuity and inventive and constructive ability. Any cost system must be adapted to the special needs of a particular business.

As an illustration on this latter point, we may instance the manufacture of a straw hat. The material that enters into a straw hat consists of the *braid,* which is the straw; the *band,* which goes around the outside of the hat; the *sweat,* or the leather inside the hat; the *lining;* and the *thread.* All these materials, according to one of the fundamental principles of cost accounting, should be charged as a direct or a prime cost; and yet, in this case, there is one element of the material cost that it would be very impractical so to charge. This material is the thread. The only way to take care of the thread in a straw hat is to distribute the cost of the thread along with other departmental overhead, over the total number of straw hats produced, even though they may represent many different styles. This element of material cost is distributed as an indirect expense instead of as a direct-material cost, because it would cost more than the price of the thread itself to ascertain the amount entering into

any number of a particular style of hats. This instance is cited to make emphatic the fact that there are many cases in which it is necessary to depart from fixed and standard principles if anything like a common-sense system is to be installed.

In order to devise a practical and satisfactory cost system, a physical examination of the particular plant would be absolutely essential for the purpose of ascertaining not only the product manufactured, but the conditions under which the product is made. There are primarily three steps in the introduction of a cost system: (1) making a physical examination of the plant in question; (2) devising the system; and (3) installing the system.

In making the physical examination, it is fitting to begin with the operating departments of the plant and to end with the office records. Some one connected with the plant, who has a practical knowledge of the business, should accompany the expert for the purpose of answering all questions that it may be necessary to ask.

In the examination of a manufacturing plant, the information should be divided into the following general divisions: (1) raw material; (2) machinery and processes; (3) direct labor; (4) indirect labor and supplies; and (5) general indirect.

The classification of *material* should cover the different classes of material that are used directly in the manufacture of an article, the method of receiving material—and by this is meant not only the matter of recording but the method of handling the material—and the question of storeroom accommodation. In many lines of business, practically all material may be stored in stock rooms, but there are cases where this is impracticable. In the case of pig iron, for instance, it would be necessary to have this material located in a place convenient to the cupola. Other things to be considered in connection with a storeroom are the value of the material and its bulk or size, and whether the material is to be used through the medium of a bill of material or a material requisition.

Under the general classification of *machinery and processes*, the information to be obtained must be such as to give one a knowledge of the different classes of machinery or processes and the average and maximum efficiency of each; also, whether they are automatic or not.

From the time that the material is started into process it should be followed through the various operations until it goes either into the storeroom or into the shipping room as a finished product.

Every manufacturing plant should be divided into a number of operating departments; in the majority of cases, these departments are determined by the expert with the assistance of the manager. An operating department is composed usually of a part of the plant in which all the processes are of the same general nature.

The *direct labor* and the *machinery* of each operating department may now be taken up. The number of machines should be known, as should also their cost and the number of workmen both direct and indirect in each operating department. In connection with the operating departments, there should also be ascertained not only the amount of indirect labor that is applicable, but also the nature of the supplies that are peculiar to each department.

The next classification to be prepared would be the *general indirect expenses* of the plant, and by this is meant that class of labor and supplies and fixed charges which cannot be properly charged to any particular operating department.

There are two conditions in manufacturing that must be clearly known so far as the material is concerned. In certain cases the material passes through a few or all operating departments of the plant and is continuous until it becomes a finished product ready to be shipped. On the other hand, in perhaps the majority of plants, the material is made into finished parts, and these parts go into the storeroom as *partly finished stock*. They may either be sent directly to the assembling department or have other operations added at some future date. In all such cases where partly finished stock is made, it would be taken out of process with all the cost bearing thereon, including the indirect, and carried in the storeroom at that cost.

Office Organization

After the examination of the plant is finished, the expert may commence with the office records. A very important phase in connection with the devising of a cost system, is the office organization. Before the kind of system is determined on, it should be known to what extent the present organization is able to handle any new plans that may be introduced, and whether or not the management would be willing to employ efficient help to take care of the details of a complete system. A great many cost systems have been thrown out after being introduced simply because they were top-heavy for the office organization to handle.

It is frequently advisable to put into a plant the simplest kind of a system, and then to amplify this system at later periods, as the conditions of an organization may demand. The question may be asked as to whether a complete cost system should always be recommended for all manufacturing businesses, large or small. The answer is decidedly "No." If it were also asked as to where the line should be drawn, the answer is that it would depend not only on the size of the plant but on the office organization.

There are many manufacturing industries in which it is good policy in the improvement of their cost records first to work along the lines of the least resistance instead of attempting to reach the maximum results at once. It is sometimes good business policy to repair a machine instead of throwing it out, and

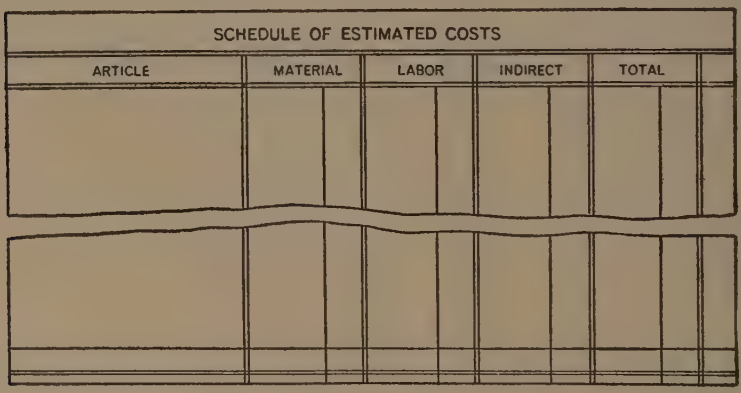


FIG. 50

in the case of installation of modern machinery, to make the introduction gradually instead of installing a complete set of new machinery.

Carrying the last thought in mind, it should be clear why estimating cost systems are considered here. The estimating methods do not show the manufacturer how to figure his costs, but help him to determine whether or not his estimates are accurate. If the proper accounting checks are made on the estimating cost records, it will serve the purpose of demonstrating whether or not the estimates are reasonably accurate.

If it should appear that these estimates are widely inaccurate, then we must go one step higher. This leads to the first element in actual cost finding, and the simplest one so far as actual cost systems are concerned. This system would be properly termed a *departmental cost system* (departmental only in

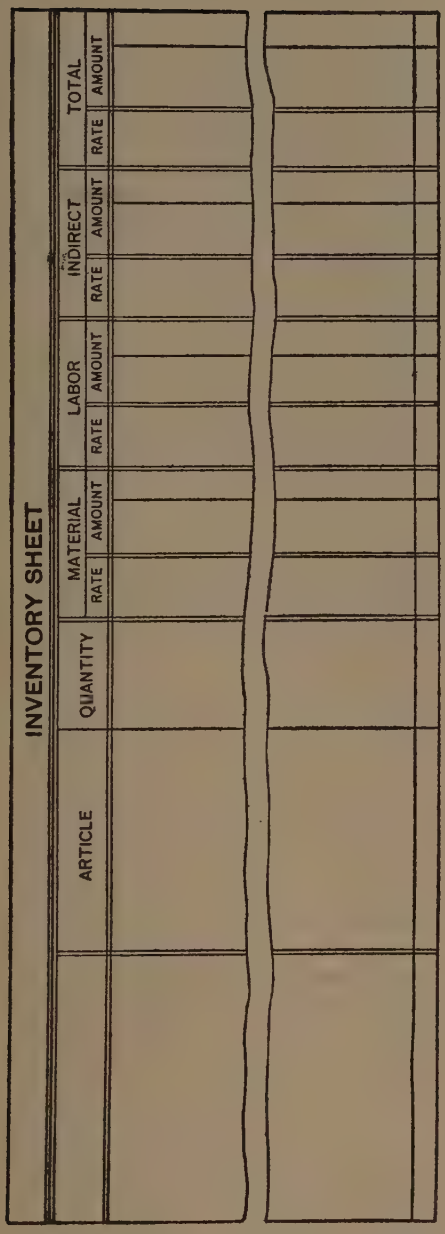


FIG. 51

the sense that the actual costs are shown on classes of product and not on an article).

PRIMARY COST SYSTEM

First Method

A primary cost system is based on the annual verification of the three elements of cost, namely, material, labor, and indirect expenses. Three distinct methods are in use.

Schedule of Estimated Costs

The estimates of the costs are recorded in a form termed the *schedule of estimated costs,* which is illustrated in Fig. 50.

Inventory Sheet

The first step in the primary cost method is the valuation of the inventory at the time the system is introduced. In Fig. 51 is shown a blank form that may be used in dividing the value of the inventory so far as it relates to raw material, goods in process, and finished stock, into the three elements, namely, material. labor, and indirect.

The prices shown in this schedule are the ones that should be used in pricing the inventory, not only at the beginning of

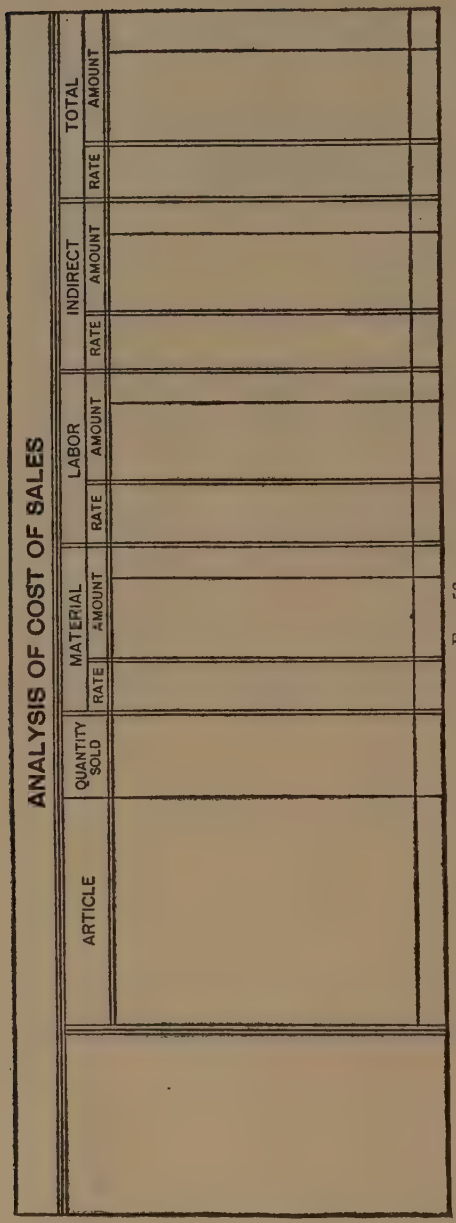


FIG. 52

the period, but also at the end of the period; and these same prices are used in connection with entering the cost price on the analysis of cost of sales. For this reason, whatever form is used, it should be convenient and specific in design.

In Fig. 52 is shown the analysis of cost of sales. It should be observed that in the simplest primary method only three forms are used.

Since the quantity and kind of goods sold constitute a prominent part of this plan of verification of estimated costs, it will be necessary to prepare a statement showing all the articles sold between the time the inventory was first taken and the close of the inventory period. After this schedule has been prepared and the total quantity of each article sold ascertained, the cost price of the three elements shown in the schedule of estimated costs should be entered in the three columns provided for material, labor, and indirect expense, and the total costs of each one of these elements should be extended in the amount columns for the quantity of each article sold. The

amounts of these three elements should then be entered in the total cost column, after which all the columns should be added to ascertain the totals of each element as well as the final total cost.

Plan of Verification

Since the totals of the three elements entering into the cost of production, as shown in the inventory at the time this system was started, have been charged against these three elements in the ledger, and as the purchases of materials, exclusive of general supplies, have been charged against the material account during the inventory period, and as the same is true in the case of the labor account and the indirect expense account, it is clear that, if these accounts are credited with the inventory at the end of the period according to the same classification, the difference between the two sides of the account will show the cost of material, labor, and indirect expenses expended in the manufacture of goods actually sold. These same items of cost are shown by the analysis of cost of sales.

If the estimates are correct, the total amount shown for material, labor, and indirect expenses in this analysis of cost of sales should agree with the balance of each of these accounts in the ledger. If the ledger balance for any account exceeds the amount shown in the analysis of cost of sales for the same account, the difference will mean that the estimated-cost figures are too low by exactly the amount of this difference. If the reverse is the case, it will mean that the estimated costs are higher than the costs as figured. The manufacturer may judge for himself, according to the result considered in connection with trade conditions, which is the more detrimental to his business.

If it is desired to incorporate the verification figures in the ledger, the entry would be as follows: Credit these accounts (that is, the material, labor, and indirect expense accounts, respectively) with the total cost of all the amounts shown in the analysis of cost of sales; and in the same entry charge the total of these three amounts to the sales account, which account will then show the gross profit, based on the estimated-cost calculations. After this has been done, the three accounts mentioned will show the theoretical inventory in each of these accounts, based on the estimated cost.

These balances should then be compared with the actual inventory at the end of the period showing the total material, labor, and indirect expense. If the theoretical inventory exceeds the actual, the difference should be credited to these accounts and the total amount charged to the sales account, which account

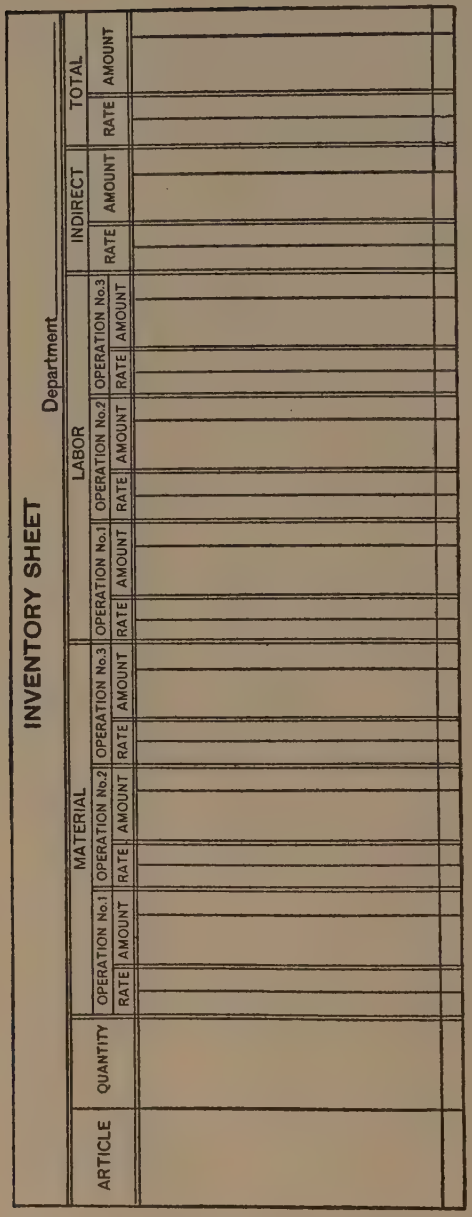


FIG. 53

will then show the actual gross profit instead of the estimated gross profit. If the reverse is the case, the entry would be reversed, and the result would mean an extra gross profit. If the manufacturer has sufficient confidence in his estimates of costs and desires to have his bookkeeper prepare a monthly statement showing the profits based on these estimates, these entries may be made monthly instead of at inventory periods, and any differences in the results adjusted at the end of the year.

SECOND METHOD

Inventory Sheet

In the primary method just described only the three elements of costs, namely, material, labor, and indirect expense, are treated as applying to the total costs of the factory, regardless of operations, processes, or shop orders. If it is desired to carry a step further the primary method for the purpose of analyzing into divisions the three elements, in order that more light may be obtained on the proof of the estimates, a form like that shown in Fig. 53 would be used.

This form, as will be observed, divides the material into three divisions and the labor into three divisions. Instead of the heading Operation, however, Department or Classification may be used if desired. The distinctive feature of this method is that the first two elements of costs are subdivided and analyzed so as to show or to check the proof of the estimated costs into classes of material and labor, the indirect-expense method remaining precisely the same as before.

After the total amount of the entire inventory has been ascertained, separate accounts should be opened in the ledger with each class of material and the labor in each department, as well as the account for indirect expenses. The totals of this

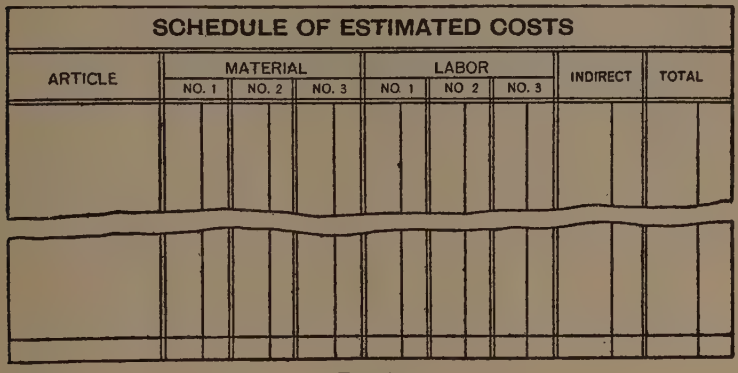


Fig. 54

inventory should be entered in each of these accounts in order to provide for verifying each of them when an actual inventory is taken.

Schedule of Estimated Costs

In the schedule of estimated costs, shown in Fig. 54, both the material and the labor column are divided into three parts, representing the three classifications.

This classification of material and labor should be identical with that in the inventory sheet. The same classification, after having once been established, must not be changed under any circumstances unless all are changed, as it would prevent verifying the estimated cost. The remarks relating to the schedule and explaining how the information should be used apply in this case, as before. The cost prices to be entered on this schedule are the estimated costs that it is desired to verify, and it is assumed that a record of these prices is already in the possession of the management and is in such shape as to be easily dissected

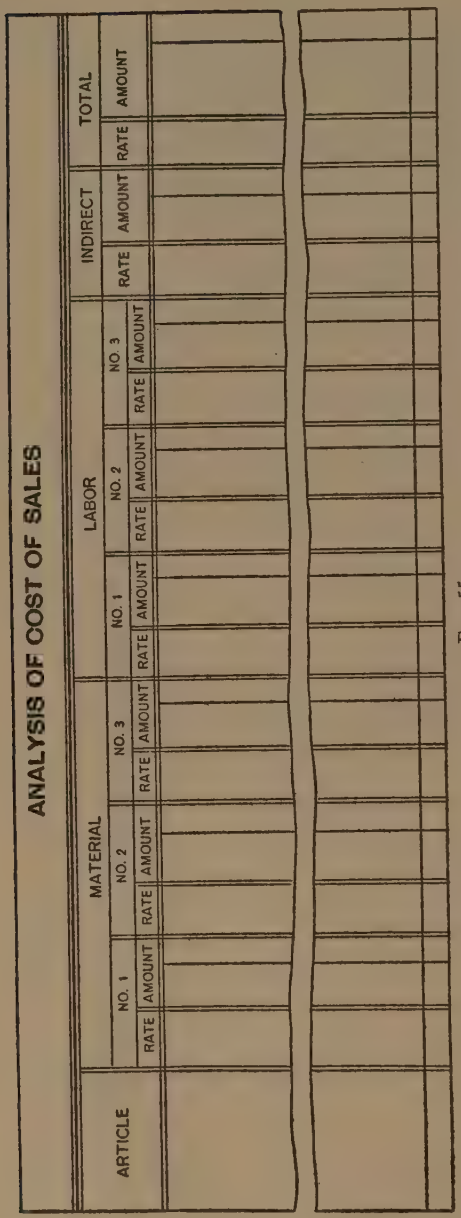


Fig. 55

or analyzed. In the second method, the analysis of cost of sales would be divided into the three classifications in the same manner as the inventory sheet and the schedule of estimated costs. Fig. 55 shows how such an analysis of cost of sales would appear.

Purchase Journal

In order to facilitate the itemizing of the three classifications, it would be well to introduce a purchase journal similar in form to that shown in Fig. 56. This book provides that material be classified according to the captions shown in the inventory sheet. Purchases are entered in this record to be posted to the credit of the various accounts for individuals and companies from whom goods are bought, and the amounts of these purchases are distributed and entered in their respective columns, which, in effect, classifies the purchases according to the accounts already opened in the ledger. At the end of the month the totals of these columns are posted to the debit of the account appearing at the head of the column.

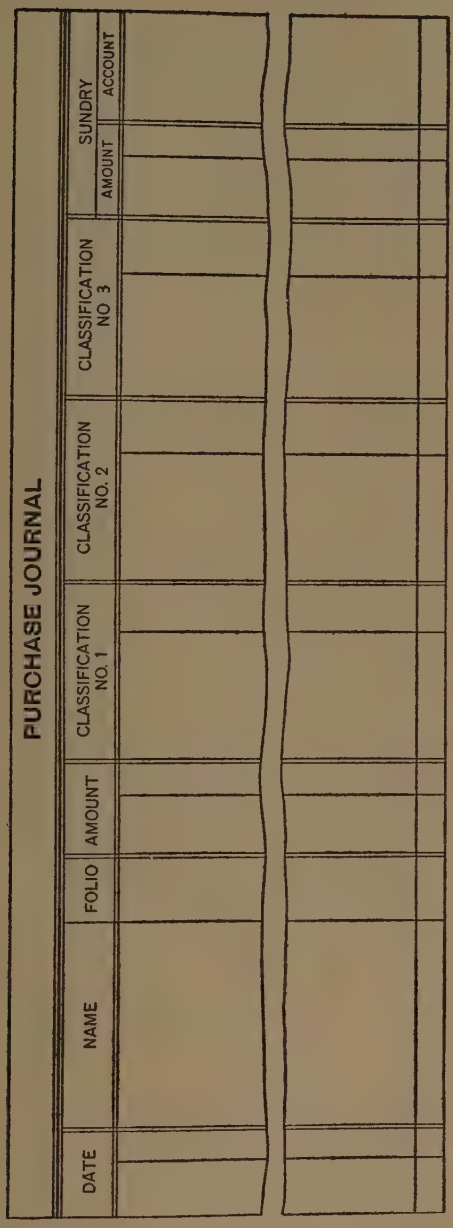


Fig. 56

Pay Roll

As the labor is also divided into departments, a pay-roll form like that shown in Fig. 57 is suggested for this purpose. This form shows in total the amount of each employe's pay in each operating department, as well as the indirect labor, supervision, etc. The totals here obtained should be entered in the ledger through the cash book, or by means of a journal entry to the debit of the departmental labor accounts and the indirect-expense account. In classifying this labor, the distribution must be made according to the way the labor was classified in the beginning inventory and in the estimated costs. Otherwise, misleading results will be obtained.

Plan of Verification

The principles involved in this second method are identical with those of the first, although the method of verification and the results are more complete. It is possible to show in this instance not only that the material has been inaccurately estimated, but which kind of material; and the same is true in the case of labor.

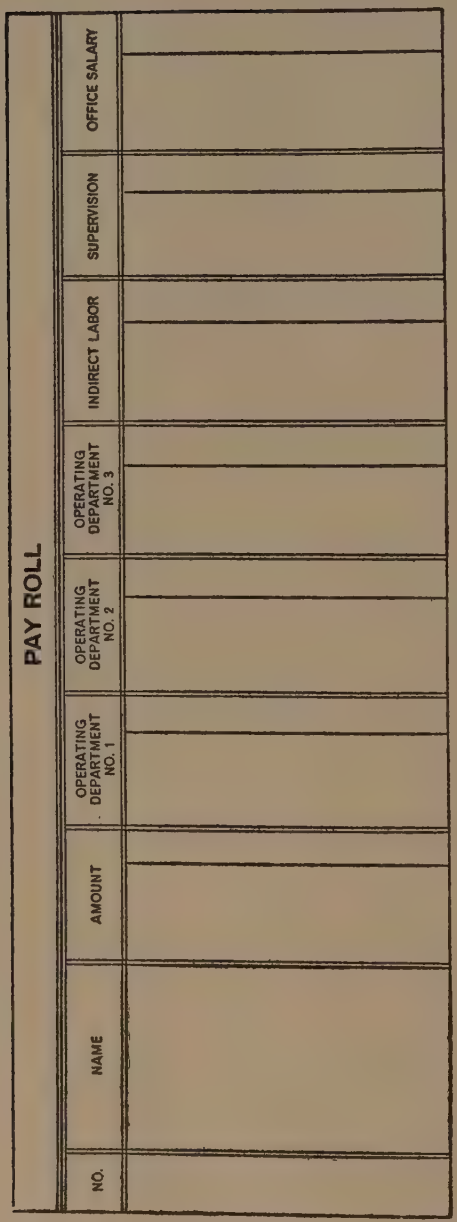


FIG. 57

Where labor amounts to a considerable sum, and large inaccuracies have occurred in any one department, a careful examination of estimates relating to articles manufactured in this department can be made, and the estimates revised for future use.

This method will be started in the same manner as the first method, by charging to each material and labor and indirect-expense account the amount shown in the beginning inventory in the columns provided for these different accounts. This will be the means of opening these accounts in the books to make the plan operative. After this has been done, the purchases should be entered and charged to these accounts from the purchase journal. The labor can be charged to these accounts from the cash book or by making a journal entry, at the option of the bookkeeper.

At the end of the year, or whenever it is desired to verify the estimated costs, an inventory should be taken on the same form and in the same manner as the beginning inventory, so far as the classification is concerned. This inventory

should be credited to these accounts, which will then show the costs of the various kinds of material used in the manufacture of the goods as sold, as well as the labor in the several departments and the indirect expenses incurred, all of which should be transferred to the sales account or the loss-and-gain account and the books closed.

The amount so transferred, representing the cost of all the material and labor, as well as the amount of the indirect expenses, should now be compared with the results shown in the analysis of cost of sales, where all the costs appear as estimated according to the same classification. The difference between the two amounts will represent the inaccuracies in estimating costs, the inaccuracies for each classification being shown.

From this it can be seen that, since the accounts in the ledger have been charged with the beginning inventory relating to each account, and subsequently with all the purchases, labor, and expenses, and since they have been credited with the inventory at the end of the period, analyzed in the same way, the balance represents the cost of all the goods sold. The schedule showing an analysis of estimated costs, when compared with the calculated costs, will indicate wherein the estimated costs are at fault. The amount or extent by which the estimated costs are inaccurate will regulate the action to be taken in revising estimates.

Before entering the inventory in the ledger or closing the books, it should be determined whether the result of this verification of estimates is to be recorded in the general books. If it is to be recorded, the following is the proper plan of procedure: Credit the several material and labor accounts and the indirect-expense account with the amounts shown in the analysis of cost of sales. Charge the total of all these estimated costs to the sales account or the loss-and-gain account, according to the manner in which the books are closed. Then take the difference between the balances shown in the material, labor, and indirect-expense accounts; compare these balances with the total of the inventory according to the same classification, and ascertain the exact amount of the difference. Enter this difference in the general books by means of a journal entry to the debit or credit of the sales or the loss-and-gain account, and credit or debit the several material and labor accounts and the indirect-expense account with the amount of the difference relating to each account. These accounts will then show the actual inventory of the material, labor, and expense account, and will correspond with the totals shown by the actual inventory. The

sales or loss-and-gain account will then show the gross profit based on actual figures; whereas, before this entry was made, only the estimated gross profit appeared. The term *gross profit* as here used means the difference between the selling price and the actual cost price, including indirect factory expenses, but not including such expenses as selling and administrative expenses.

A monthly loss-and-gain statement and balance sheet can be prepared from the general ledger, provided the entries relating to the analysis of cost of sales are prepared and entered in the records monthly instead of only at the end of the year. The same information will then appear in the ledger account relating to this particular part of the bookkeeping as if the entries were made annually, except that no adjustment of inventories and therefore no verification of estimated costs can be made. The accuracy of the profits shown will naturally depend on the accuracy of the estimates.

Third Method

A still further amplification of the primary cost system may be used. The principal feature of this method, which may be called the *third method,* is the comparing of estimated costs with the actual results on the classes of product manufactured. It is the most extensive and most complete method that can be used in a primary cost system without taking on the features of an actual cost system. The forms of inventory sheet, schedule of estimated costs, analysis of costs of sales, purchase journal, and pay roll, are similar in character to those described in connection with the second method. The following course is pursued in using this form of estimated costs.

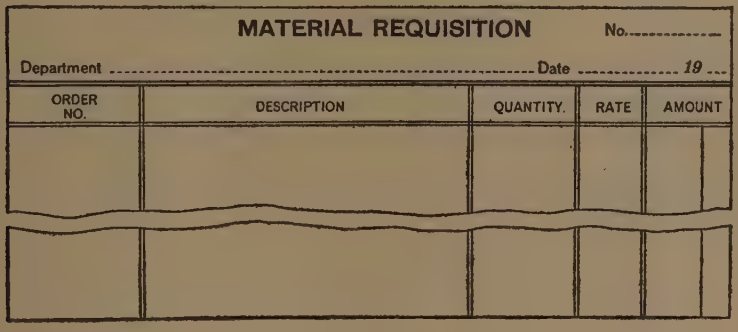
Inventory Record

Use a separate sheet or several sheets, as the case may demand, for each department and extend the estimates of cost in the several material and labor columns and in the indirect-expense column. This furnishes an analysis of the total estimated cost of the articles and presents the information necessary to open the ledger accounts for this classification of product. It can thus be seen that for each department there will be several ledger accounts for material and labor and one for indirect expenses. The total shown by the inventory for each department should be charged to these accounts.

Attention is called to the method of treating raw material on hand not relating in any way to goods in process of manufacture or to the finished product. The amount of material in

the storeroom or in the plant, upon which no labor has been expended, should be entered on a separate sheet in the ordinary way, and the total of this amount should be charged to an account in the ledger styled *Storeroom* or *Raw Material.* This account will be charged from month to month with all purchases relating to material not in the nature of supplies, and will be credited from month to month with the raw material drawn out, as reported by the material requisitions that are used in connection with this method.

The only difference between the purpose of the schedule of estimated costs for the third method and the purpose of the one in the second method lies in the use of the information furnished in pricing the inventory at the beginning and the end of the



MATERIAL REQUISITION No.

Department ..... Date ..... 19 ...

ORDER NO.	DESCRIPTION	QUANTITY.	RATE	AMOUNT	

FIG. 58

period, and in pricing the sales during this period. This difference, however, does not affect the form in any way. Any additional information affecting other forms will be explained when those forms are reviewed.

Analysis of Cost of Sales

Although the analysis of cost of sales for the third method may be the same in design as that for the second method, its use is somewhat different. This difference consists in using separate sheets for each classification of product, showing all the articles sold between the two inventory periods and giving an analysis of the estimated cost as before. In the second system, the articles are entered without any regard for classification except as relating to particular departments. Of course, any classification must be identical with the beginning-inventory classification in order to verify the estimated cost of each class.

SUMMARY OF MATERIAL REQUISITION

CLASSIFICATION NO. 1		DEPT. A				DEPT. B				DEPT. C			
		NO. 2		NO. 3		NO. 1		NO. 2		NO. 3		NO. 1		NO. 2		NO. 3	
NO.	AMOUNT	NO.	AMOUNT	NO.	AMOUNT	NO.	AMOUNT	NO.	AMOUNT	NO.	AMOUNT	NO.	AMOUNT	NO.	AMOUNT	NO.	AMOUNT

Fig. 59

Purchase Journal

The purchase journal for the third method may be used on the same general lines as that for the second method. However, only one column for material is necessary, as material requisitions are to be used for the purpose of classification. All materials and purchases can now be charged to one account, the distribution to the respective departments being made from the material requisitions. The total purchases of material for the month, exclusive of supplies in the nature of an expense, should be posted to the debit of the storeroom account, which account was charged with the inventory of raw material at the beginning of the period.

Material Requisition

The material-requisition form, Fig. 58, was not necessary in the first and second methods, but it must be used in the third method to make the plan operative. As has already been shown, the total amount of raw material indicated by the inventory is charged to a storeroom or a raw-material account in the ledger, to which account is also charged from month to month the total pur-

chases of such material. Consequently, this account should receive credit each month for all material delivered to the operating departments chargeable to the several classes of product for which the material was used. These material requisitions should be priced according to the invoice or cost prices. After this has been done, the storeroom or the raw-material account will naturally show the value of the raw material on hand, based on inventory or purchase price. When these requisitions have been priced, a separate one being used for each classification or product to which the material is chargeable, a summary should be made each month showing the classification of product chargeable.

Summary of Material Requisitions

As the name implies, a summary of material requisitions, Fig. 59, is merely to be used for the purpose of obtaining the cost

TIME TICKET

Name Date

SALES DEPARTMENT	ORDER NO.	DESCRIPTION	TIME	RATE	AMOUNT

Fig. 60

of material used during the month, chargeable to the various classifications of product. Any other form, as to ruling, columns, etc., that will furnish the same information may be employed if preferred. The results obtained, however, should be entered in the journal, and each classification of product charged with the amount of material shown; the total amount of all material used should be credited to the storeroom or the raw-material account.

Time Record

Since the third method involves ascertaining the labor chargeable to each classification of product, according to operating departments, it will be necessary to use a time report similar to that shown in Fig. 60. A separate report should be made out by each employe of the plant whose time relates in any way to

the product manufactured. This report should show the department in which the employe is engaged and the class or product to which his time is chargeable. The method of summarizing this information is explained in connection with the pay-roll form that follows.

Pay Roll

The pay-roll form for the third method is similar to that for the second method and is illustrated in Fig. 57. It shows in total the amount of each employe's pay in each operating department chargeable to each classification of product, as well as the amount of indirect labor. A separate sheet should be used for each operating department, and the columns from left to right should be headed with as many classifications of the product as are to be kept, instead of the number of the departments as in the illustration. The total of this pay roll as analyzed may be entered in the cash book, showing the labor chargeable to each classification of product according to operating departments, as well as the indirect labor, etc., and can subsequently be posted in the ledger to the debit of these accounts.

If desired, only the total may be entered in the cash book, which can be posted to the debit of a pay-roll account. The pay-roll account can then be credited, through a journal entry at the end of the month, and the proper accounts for the classifications of product, as well as for indirect labor, can be charged. This last method will prove more satisfactory than the first, as the entry distributing these charges may be made monthly instead of weekly.

Plan of Verification

The object of the third method, as before explained, is to verify the estimated costs relating to each classification of product according to certain general subdivisions of material, labor, and indirect expense.

It has also been shown that separate accounts must be opened in the ledger with each classification of product for various materials relating to the product, for each operating department labor charge, and for the indirect-expense charge. A separate account must also be opened for the storeroom or the raw-material account. The inventory must be transferred or entered to the debit of these several accounts. After this has been done, the subsequent purchases of raw material, exclusive of supplies, should be charged from the purchase journal to the raw-material account, as previously explained. The labor chargeable to these various classifications of product according to operating departments, may be entered in the ledger weekly or monthly

through the cash book or the journal, as is explained in describing the pay roll.

It will now be seen that all direct charges, such as material and labor, have been entered to the debit of the classification of product to which they relate, and it will be observed that an account appears in the ledger styled *indirect expenses*, not relating to any of these classifications of product, but which should be charged or prorated among them. This can be done by dividing the total amount of indirect expenses by the total labor charged to all the classifications of product. The rate or the per cent. thus ascertained should be multiplied by the amount of labor charged to each classification of product, and the result distributed or charged through a journal entry to each of these products as indirect expenses, the total amount being entered to the credit of the indirect-expense account proper, which account should then balance.

All classifications of product are now charged with all expenditures relating to the cost of production. The next question to consider is the means of crediting these various classifications of product with the amount of goods sold at estimated cost, the estimated cost being analyzed in the same way in which the expenditures or charges are analyzed. This information is contained in the analysis of cost of sales. Therefore, if the totals shown in the analysis of cost of sales for each classification of product are credited in the ledger to the corresponding account, these accounts will show the value of the inventory based on the estimates. This result should agree at the end of the year, or when an inventory is taken, with the actual inventory, provided the closing inventory has been taken in the same way and at the same prices that the cost of sales were priced.

The difference between the actual inventory and the theoretical inventory, shown in the books, will represent the inaccuracy in estimating costs, not only in the class of product, but also in the various accounts of material, labor, and indirect expense. This information will show which class of product has been inaccurately estimated and where these inaccuracies are most prominent; it will also show in what department the labor or material was inaccurately estimated, and to what extent calculations and distribution of indirect expenses have affected the errors in estimating costs.

Statement of Profit and Loss

The object of presenting the statement of profit and loss, Fig. 61, is to illustrate more clearly the results of operating this

STATEMENT OF PROFIT AND LOSS — For the *month* — ending *Jan. 31-* 19.

DEPARTMENTS	SALES		GROSS PROFIT		EXPENSES						NET PROFIT	
	Amount	Cost	Amount	%	Selling	%	Administrative	%	Total	%	Amount	%
A	18 833 90	9 334 08	9 499 82	102.0	3 664 10	39.1	1 508 06	16.2	5 162 16	55.3	4 337 66	46.7
B	1 799 36	1 086 30	712 56	65.5	424 42		175 18		599 60		112 96	10.2
C	3 463 94	1 586 62	1 877 32	118.3	621 04		256 54		877 58		999 74	63.0
D	1 712 10	952 04	760 06	79.8	372 64		153 94		526 58		233 48	24.6
E	1 698 06	1 102 60	595 46	54.0	431 40		178 08		609 48		14 02	- 1.3 -
F	883 38	419 72	463 66	110.5	164 28		67 84		232 12		231 54	55.2
G	3 791 90	2 324 44	1 467 46	63.1	909 64		375 82		1 285 46		182	7.8
H	1 247 98	568 04	679 94	119.7	222 34		91 86		314 20		365 74	64.4
I	6 538 92	3 154 18	3 384 74	107.3	1 234 62		509 80		1 744 42		1 640 32	52.0
J	2 745 24	1 586 62	1 159 62	73.1	624 44		256 08		880 52		279 10	17.8
K	842 88	469 68	373 20	79.5	185 84		73 84		259 68		113 52	24.2
L	544 76	270 68	274 08	101.3	105 94		43 72		149 66		124 42	46.0
M	16 070 42	8 106 44	7 963 98	98.2	3 172 88		1 309 08		4 481 96		3 482 02	42.9
N	844 38	561 44	282 94	50.4	219 76		90 74		310 50		27 56	- 4.9 -
O	5 786 80	3 951 02	1 835 78	46.5	1 546 34		638 14		2 184 48		348 70	- 8.8 -
P	673 36	319 16	354 20	111.0	124 96		51 68		176 60		177 60	55.7
From Operating												
All other Income and Expenses												
From all Sources	67 474 88	35 790 06	31 684 82	88.5	14 012 60		5 782 40		19 795		11 889 82	33.2

Approved: ..... Correct: .....

FIG. 61

plan. First, however, it may be well to explain more fully the closing entries just described from a bookkeeping standpoint. At the end of the month, when the total sales at the selling price have been ascertained according to the respective classifications of product, the total sales for each classification should be credited to the sales account for that classification or product, this account being independent of the accounts already opened for the same product. The accounts previously opened relate to expenditures and cost and show the inventory, but have no connection whatever with the sales at the selling price. The purpose of opening a separate account for each classification or product sold can now be understood. These accounts should be charged with the total cost for each classification or product, as shown by the analysis of cost of sales, and this entry represents the debit for the corresponding credit that has been posted to the various accounts. The sales accounts for each classification are credited with the sales at the selling price and are charged with the sales at the estimated cost price, and the difference or balance as a consequence represents the estimated gross profit.

In preparing the profit-and-loss statement it will be necessary to refer to the ledger account, and enter the sales and the estimated cost of the sales that already appear in the account in the columns provided for that purpose. The difference between the two amounts is extended in the column headed Gross Profit, opposite the department to which it relates. The next step is to ascertain, by referring to the accounts styled selling expenses and administrative expenses, the total of these accounts, and enter these amounts in the proper columns. The per cent. that the selling expenses bear to the estimated cost of goods sold should be ascertained, and the estimated cost in each department multiplied by this per cent. The same procedure should be followed in the case of administrative expenses. In this way, the selling expenses and the administrative expenses are distributed among the several departments. These two amounts, that is, the selling expenses and the administrative expenses, should then be added and the sum entered in the total column, opposite the proper department. These amounts will then represent the total expenses chargeable to each department. By deducting these expenses from the estimated gross profit appearing opposite each department, the net profit is obtained, and this is entered in the column headed Net Profit. The total of this column, showing the estimated net profit of each department, will indicate the total estimated net profits of the business, the

COMPARATIVE BALANCE SHEET.

January, 31, 19

ASSETS	CURRENT MONTH		Increase or Decrease		LIABILITIES	CURRENT MONTH		Increase or Decrease	
Accounts	Amount	Amount	Amount	Amount	Accounts	Amount	Amount	Amount	Amount
CURRENT ASSETS					CAPITAL STOCK		250 000 —		
Cash		6 008 43		1 010 76					
Notes Receivable		2 145 —		— 100 —					
Accounts Receivable		85 749 21		— 5 020 19					
Raw Material		36 487 24		10 263 66					
Material-Finished & In Process		49 562 30		4 042 62					
DEFERRED CHARGES:					CURRENT LIABILITIES:				
Selling Expense		2 741 92		192 67	Notes Payable		37 500 —		— 2 500 —
Administrative Expense		941 76		74 21	Vouchers Payable		42 408 70		1 734 58
PROPERTY					Pay Roll		4 721 95		642 81
Real Estate		60 000 —			RESERVE FUNDS:				
Buildings		120 475 90			For Discounts		4 287 46		— 256 01
Machinery & Tools		176 418 07		1 675 29	For Doubtful Accounts		600 —		
Factory Furniture & Fixtures		8 020 94		215 76	For Depreciation		2 400 —		300 —
Office Furniture & Fixtures		5 118 90		100 —	For Taxes		572 91		572 91
PATENTS, PATTERNS & DRAWINGS:					For Interest		1 549 25		246 65
Patents		7 500 —			MORTGAGE		100 000 —		
Patterns		12 645 —		145 —					
					SURPLUS		116 934 57		
					NET PROFIT for the current fiscal year to date		11 889 82		11 839 82
Total Assets		572 764 66		12 629 76	Total Liabilities		572 764 66		12 629 76

FIG. 62

accuracy of which will depend entirely and absolutely on the accuracy of the estimated costs.

After the selling and administrative expenses chargeable to each classification of product have been ascertained, these accounts, that is, the selling and administrative expense accounts, should be credited with the total amount, and the various classifications of product charged with the proper amount. These classification accounts will then show the estimated net profit on the various classifications of product sold, which amount should then be transferred to the general profit-and-loss account in the usual manner.

Balance Sheet

The style of balance sheet employed in this method is shown in Fig. 62. Persons familiar with bookkeeping will readily understand this statement, which represents a trial balance after the books have been closed. From a bookkeeping standpoint, it does not differ from any other balance sheet; but, from a business standpoint, it differs to the extent that the accuracy of the inventory shown is based on the accuracy of the estimates of cost used in crediting the several classifications of product. As this plan provides for preparing this statement monthly, based on these estimated inventories, attention is called to the fact that when the actual inventory is taken the difference between the estimated and actual figures should be credited to these accounts and charged to the sales account for the same classification. This means that, if the theoretical inventory or the balance as shown in the books exceeds the actual inventory, the inventory accounts must be credited and the sales accounts charged; and where the actual inventory exceeds the balance shown in the ledger account, these entries should be reversed.

DEPARTMENTAL COST SYSTEM

Costs and Profits at Inventory Periods

As the function of a departmental cost system and its relation to the primary and complete systems have been made plain it only remains to explain the procedure and the forms employed.

Production Order

The purpose of a production order is to substitute written instructions for verbal direction in the manufacture of all products in the several operating departments, and to enable the management to direct and regulate the production of any class of product called for by orders from customers. The proper use

of such a form will enable the management to keep in touch with all that is going on in the several departments and to supervise the labor forces and the heads of the several departments in such a way as to materially increase the efficiency of the plant

Bill of Material

The purpose of the bill of material is to prepare estimates showing all the material used in the manufacture of either a special order, which means a class of product that may or may not be manufactured in the future, as well as for standard goods that will be constantly carried in stock. In the latter case, a bill of material should be made up and priced for every article that is carried in stock, and this price, or cost, should be revised from time to time as the cost of raw material increases or decreases in market value. Otherwise, inaccuracies would necessarily occur in transferring material used from the raw-material account to the departmental account, as will be seen later.

Another purpose of this form is to record the calculations of the amount of material used for each month that is chargeable to the several departmental accounts. The total of the bill of material is credited to the raw-material or the storeroom account, which should be charged with the inventory at the beginning of the period and with all purchases made since that time.

Time Reports

Every employe in a plant should make out a time report daily, showing the number of the production order, the nature of the work engaged on, the time consumed, and, if practicable, the number of articles produced. The foreman of the department should make it his business to examine these reports daily and turn them into the office at night or the following morning, with his name signed to each form. The management should ascertain whether or not these reports are really examined or merely signed. It is an easy matter, particularly where a complete cost system is not in use and where stock records are not kept, to falsify piece-work reports without the knowledge of the management or the foreman.

The results shown by time reports should be transferred daily to the analysis of pay roll.

Analysis of Pay Roll

All of the data called for by the analysis of pay roll should be obtained from the time and piece-work reports. At the end of each day, the time reports should be entered opposite the

name of each employe, and if the results are based on piece work the quantity should also be entered. The total for the week should be entered for day workers, and for piece workers and the rate per hour or per article also should be entered. The result, that is, the rate multiplied by the time or the quantity, should be entered opposite the employe's name.

Under Distribution should be entered the amount of each employe's wages chargeable to the particular classification or kind of goods on which he was engaged. Any time not chargeable to any particular class of goods should be entered as indirect. The total of this distribution, that is, labor chargeable to the various kinds of goods manufactured and the indirect labor added together, should equal the amount of the employes' wages for the week.

When the pay-roll check is drawn and entered in the cash book for the weekly pay roll, the amount should be charged in the ledger directly to the pay-roll account; and at the end of the week or the month a journal entry should be made crediting the pay-roll account and charging the various kinds of products appearing in this analysis of pay roll, as well as the indirect-labor account. This entry will balance the pay-roll account, and charge or distribute the amount of the wages to the proper accounts or departments for the period in question.

Production Report

Several methods are employed in reporting the production of finished parts departmentally, as well as finished products. In case several departments operate independently, that is, each to produce a finished product, a separate report should be used for each department, with all the articles appearing. If the entire product passes through all the departments and is delivered to a stock room or a stock clerk, one report will be sufficient. The information can be obtained from either the production orders or from the time and piece-work reports. Entries of the daily production should be made each day under the proper date opposite the article produced. The total should then be extended for the month.

On receipt of this report properly filled out, the bookkeeper or the cost clerk should fill in the material costs. All the information called for can be obtained from the bill of material. The number of this bill of material and the cost, or rate, per article, should be entered, as should also the product of this rate multiplied by the total number, or quantity, of this article manufactured during the month. A number of articles may be entered

under each classification of manufactured products, which is the basis of the departmental cost system. After all these articles have been priced, and the amount extended according to classification, the total should be the classification total.

The total amount for all classifications, representing the total amount of material used for the month, should be credited through a journal entry to the storeroom or the raw-material account and charged to the various kinds of product. The effect of this entry is to credit the storeroom or the raw-material account with goods taken out and used in the manufacture of product actually finished and ready for shipment, and at the same time to charge the department or class of goods with the cost of this material.

Register of Sales

The register of sales classifies the sales according to the manufactured product. The required information for this form can be obtained from the sales sheet, and if the postings to the sales ledger are made from the bill only the total of the bill and the classification of the sales need be entered.

At the end of the month, the total amount of the sales for each department or classification of product should be credited to the proper account shown at the head of the several columns, and the total of all goods sold in all departments should be charged to the customers' ledger controlling account, provided one is kept; if none is kept, the individual postings to the customer's account is all that is necessary.

Departmental Accounts

The method of obtaining all the information required to operate a departmental cost system is now explained up to the point of entering the amounts chargeable to the several departments in the general ledger. The name of these accounts and the number required must be determined by the person who installs the system. All the data relating to the departmental accounts, as well as all other accounts, can be obtained by referring to the classification of accounts.

The results called for in these various accounts are obtained from the following sources. The labor chargeable to each department is obtained from the analysis of the pay roll, which is entered in the ledger by means of a journal entry and credited to the pay-roll account. The cost of material chargeable to these departments comes from the production report, which is also entered in the journal and credited to the raw-material account at the end of each month. At the end of the year, or

at any inventory period when the books are closed, the indirect expenses may be charged to the several departments on the basis of the amount of labor charged to each department; that is, divide the expenses by the labor and ascertain the rate, and multiply the amount of labor charged to each department by this rate, and the result will show the amount of expense properly chargeable to that particular department. All the amounts charged to these departments should be credited to the account termed *indirect factory expenses,* which account will then balance, provided the distribution of the expense is accurate.

The sales for each department should be posted at the end of the month from the register of sales to the credit of the proper department. The difference between the inventory at the beginning of the period and at the end of the period, as shown in the inventory account, should be charged or credited to the proper department account; that is, if the beginning inventory exceeds the ending inventory, the difference should be charged to the department to which the inventory relates. If the reverse is the case, the amount should be credited to the department account and charged to the inventory account. The difference between the two sides of the account for the department will now show either the gross loss or the gross profit.

The total amount of the selling and administrative expenses should next be prorated, at cost price, over the several departments on the basis of the volume of business done in all departments. The total amount charged as selling expenses to the several departments should be credited to the account called *selling expenses,* which should then balance. The same entry should be made for administrative expenses, which will then also balance.

The difference between the two sides of the departmental accounts will now show the net profit or loss of each department, which profit or loss should be transferred to the regular profit-and-loss account, the total of which will represent the net profit or loss of the business.

Raw-Material Account

All the charges to the raw-material account should be obtained from the register of accounts payable or from some similar record. The credits to this account should be taken from the production report and the amounts entered each month. At the end of the year, this account should be credited with the value of the material in the process of manufacture, exclusive of labor.

This account is closed by taking the difference between the two sides of the account, which is the theoretical inventory, and either increasing it or decreasing it to the amount of the actual inventory, the difference being charged or credited to indirect expenses.

Inventories

The most approved method of treating inventory accounts in the ledger consists in charging the beginning inventory to an inventory account, separate and distinct from the regular merchandise or department account. When the next inventory is taken, the beginning inventory should merely be increased or decreased to correspond with the actual inventory taken at the end of the period, charging or crediting the difference to the merchandise account, or, in this case, to the several department accounts.

SPECIAL-ORDER SYSTEM

Productive-Labor Method

The term *special order* designates an order that relates to goods chargeable to a particular customer or to a particular production order for goods to be carried in stock. To obtain the cost according to this system, it will be necessary to issue a separate production order for each classification of articles to be manufactured, provided the costs are charged against the order number. Should a production order that covers a number of different articles be issued, then subproduction orders must be issued for each class of articles, bearing the regular production order number and also being so designed that each separate subproduction order may be charged with costs without any complications. No matter what system may be devised, the principle involved in the use of a production order should always be carried out, as it tends to bring about a condition of systematic organization in regulation, production, etc.

In general the factory is charged with all expenditures relating to the cost of production, such as the inventory at the beginning of the period, purchases, labor, and all expenses incurred in the operation of the plant, not including selling or administrative expenses. All these costs or expenses are charged to the factory, and the factory is credited at the end of the month with the total amount of goods actually sold during the month at the cost price, the balance of the factory account representing the value of material, raw, in process, and finished.

Purchase Requisition

The purchase requisition is an organization form, because no data or figures are used from this record to compile any cost data. Its purpose is to substitute written requests for verbal statements, and it is presented with a belief that it should constitute a part of any well-organized plant in order to prevent misunderstandings in connection with the buying of raw material, supplies, etc. The person who makes out this form will differ in various plants; that is to say, the stock clerk, the foreman of the operating department, the cost clerk, or the superintendent may be the best party to make the requisition, depending on conditions. The form, when made out, is delivered to the purchasing agent or the person who has in charge the ordering of material and supplies.

The next step would be the ordering of the material, and this leads up to the purchase order.

Purchase Order

The relation of the purchase requisition to the purchase order will depend on the nature of the business. In a special-order system all the costs are charged to the order number from the material requisitions or bills of material.

Report of Material Received

By means of this form it is possible to obtain from the receiving clerk an independent report of the goods actually received. Not only does this form act as a check on the invoice, but it provides the information required to make the proper entries on the stock records.

The report of material received should be executed in duplicate, and both copies should be sent to the office, the original to the purchasing agent and the duplicate to the stock clerk. The original supplies the purchasing agent with information that that be used advantageously in following purchases upon which partial shipments have been made.

Whether or not it is advisable to enter the freight, or transportation, charges on this record and include them in the purchase price of the material will depend on the nature of the raw material purchased. As the distribution of these charges over the purchase price at times necessitates considerable detail, the question to consider is the relation that the charges bear to the article in question; and the proposition would be whether to make this charge directly against the purchase price or to include this charge in the indirect or overhead expense.

In any case, where the charges referred to amount to such a figure as to affect materially the price of the raw material charged against an article, adding these charges to the purchase price would undoubtedly be the best plan; and where the charges are not of such importance, it would be just as well to include them in the overhead charges, as the difference in the two methods would not be of sufficient importance, considering the time required to make the detailed distribution.

A separate card or sheet should be made out for each article, on the same plan or principle that a separate account is kept with an individual or a company, and the article should be charged with the amount received and credited with the amount delivered.

Inasmuch as this special-order system provides for a perpetual inventory and is calculated to establish a check, or safeguard, on the stock, it is desirable to make a practice of verifying the book inventory from time to time by taking off a list of certain articles each day or week and having the person in charge of the stock take an actual inventory of the material shown on the list for comparison with this stock record. If discrepancies exist, the stock record should be adjusted to correspond with the actual inventory on the date at which it was taken, provided, of course, that the discrepancies are small and apparently due to natural causes; otherwise, an investigation should be made and the reason ascertained. By following this plan, a more accurate inventory will appear in the records daily than can be taken at the end of the year, when everything is inventoried at one time; and, furthermore, the general effect will be productive of good results, otherwise unobtainable.

Production Order

In a special-order system, the production order may be a simple form, and the costs collected on a cost record or register; but there are classes of business in which it is just as convenient to compile the cost data on the production order, and for that reason this method is illustrated in this system.

Material Requisition

The material requisition is usually made out by the foreman of the department requiring the materials or supplies specified. In some cases, however, where the class or the quantity of material is known and stated on the production order, the stock clerk receives a copy of the production order, which is used as his requisition for the delivery of the material. The requisition,

in any event, represents an order on the stock clerk to deliver the articles called for.

After the material has been delivered, the form should be sent to the office, where the cost of the material is entered on the credit side of the stock record, this credit on the stock records meaning a corresponding debit to the production order and cost sheet.

The time should be stamped on a card of the employe, and the order or job number should be entered, as should also the machine number and workman's number. The operation upon which the workman is engaged should be checked, and all the operations should, of course, be printed on the form when it is originally designed according to the nature of the business. The time employed should also be stamped when the job is finished, so as to give an accurate account of the time consumed on the order. The employes' rate should then be entered and the cost extended. This should be charged to the same order number as is shown on the time report, and entered on the production order and cost sheet under the heading Labor. If the time is not chargeable to any particular order, but relates to indirect labor or other expense items, the same remarks apply, except that these items are not charged to orders but to indirect expenses.

All the postings to the production order and cost sheet are made from these forms after a summary of the cards chargeable to a given order number has been made according to department. The time reports should be entered in the pay roll for pay-roll purposes, and also for determining the indirect labor according to departments.

Pay Roll

The purpose of the pay-roll form is to show the time of each employe daily for pay-roll purposes, and at the same time to distribute the time at the end of the week in order to ascertain the amount chargeable to expense accounts, such as indirect labor, supervision, power, maintenance, etc., and in order to indicate the exact amount charged to orders, which should be entered in the column headed Direct. The entries on any line in these columns when added together should equal the employe's pay, and the total of the pay roll should, of course, equal the distribution of the pay for all employes. At the end of the week, after paying off, the total amount of this distribution should be charged to the several accounts shown at the head of the columns under the heading Distribution, and the amount credited to pay roll, which account should be charged through

the cash book with the amount of the check. If desired, however, this journal entry or credit to the pay-roll account can be made at the end of the month for all the pay rolls together, which method would reduce the number of entries. The result, of course, will be the same and will balance the pay-roll account. The object in keeping the pay-roll account, instead of entering the distribution in the cash book, is to show the amount of the pay roll from week to week, month to month, etc., on one account.

Finished-Product Stock Record

A separate card should be used for each article manufactured and carried in stock. The information called for should be taken from the production order and cost sheet as each order is completed, the cost sheets being filed in a separate file for finished orders. The sales sheet or the record of goods actually sold should be posted to this card. The method provided in this system for the distribution of indirect expenses consists in spreading the distribution over the costs as a whole and not departmentally. It may be used with fairly accurate results if the business is very small, or if the product is uniform in character and passes through all the operating departments. Otherwise the expenses are shown according to operating departments.

The method of preparing the statement of *factory* expenditures is identical with that of preparing a trial balance, but the accounts are so grouped as to show the amount of direct labor and material purchased, as well as the total indirect expenses in analytical form for both the current month and the fiscal year to date; that is to say, for two or three months, as the case may be, depending on the time elapsed since the beginning of the year. The indirect expenses for the month, as well as for the year to date, should be divided by the direct labor for the corresponding period, in order to ascertain the per cent. of indirect expenses to direct labor and thus be able to charge the proper burden to each order, as previously explained. The total expenditures, that is, material, direct labor, and indirect expenses, added to the inventory at the beginning of the period, less the cost of the goods sold during the period will equal the value of the inventory at the end of the period.

In a small business it would not be necessary to keep a separate book as a factory ledger, in which case all these accounts would appear in the general ledger. If, however, it is not desired to keep accounts in analytical form one account called *factory*, will answer the purpose; but it would be necessary to dissect, or analyze, this account item for item if a detailed state-

ment is desired. The inventory at the beginning of the period is carried in the factory account. The cost of goods sold during the month should be credited to the factory account, and the difference between the beginning inventory and all the goods purchased and expenses incurred during the period will represent the inventory at the end of the period, provided the costs are correct.

Sales Sheet

As the basis of this system must be the cost of sales, which means the cost of goods sold, the sales sheet is absolutely necessary.

In this special-order system the form is executed in triplicate, but as many copies as desired may be made out. The original constitutes the bill and is sent to the customer. The duplicate is sent to the shipping clerk. The triplicate represents the sales sheet, and differs from the original only in having the cost price of the goods sold entered in the column provided for that purpose, so as to obtain the necessary information to show the profit and inventory according to the plan outlined.

The cost price can be obtained from one of two sources—from the production order and cost sheet in the case of special orders, and from the stock card for finished products if the goods sold are taken out of stock. The sales sheets should be numbered consecutively and registered in the register of sales and costs, which is described later.

Credit Certificates

The credit certificate is the reverse of the billing system, its purpose being to issue a credit memorandum to customers for goods returned. The object in using the duplicate of the credit certificate is to procure an exact copy of the certificate sent to the customer; to provide for entering the cost price and the selling price of goods returned for the information of the individual who keeps the stock record of finished product; and to provide a means of deducting the amount of returns from the proper sales accounts.

The form should not be issued until a receiving report has been turned in showing that the goods have actually been returned; and in that case the clerk in charge of the finished-stock records should add the amount to the stock card for the article returned.

The duplicate credit certificate should be entered in the back part of the register of sales and costs; and the total returns and

allowances for the month, both at selling price and cost price, should be deducted from the sales before posting to the ledger at the end of the month.

Register of Sales and Costs

In the register of sales and costs are registered the sales sheets previously described, the object being to classify the sales at the selling price and cost price for the month.

At the end of the month, after the distribution has been proved, the books should be summarized and all totals entered in ink. The results should be posted to the general ledger, to the credit of the proper departments, at the selling price, and the cost price should be charged to the proper departments and credited to the factory account. It is to be understood, of course, that the individual sales at the selling price are to be debited to the customer. A register of accounts payable may be used with this system.

Process or Machine-Cost Method

The difference in principle between the process or machine-cost method of gathering cost data and the productive labor method lies in the way in which the charges are collected. In the productive-labor method, costs are charged against specific articles by classification according to the factory-order number, the factory-order number carrying the direct costs from the inception of manufacture; in the present method, the costs are charged against either a particular machine or a group of machines of the same character or process. The point is to obtain the total expense chargeable to either machines or processes, and to include, as well, the actual working hours of the machine or process during the month, so that the actual cost per hour may be obtained.

Wherever it is possible to introduce a process method by which the costs may be gathered through production centers, the costs will be more accurate and considerable time will be saved in the compilation and distribution of the data.

It should be the aim in all systems so to apportion charges as to make the arbitrary distribution of the other elements as small as possible. In this system, many items, such as power, maintenance, depreciation, supplies, insurance, and rent, may be made practically a direct charge instead of an indirect one.

Attention is again called to the use of forms, some of which are the same as those used in other systems. There are certain forms that are somewhat standardized, and may be used

in any complete cost system, as, for instance, the purchase requisition, the purchase order, the inventory of material, the payroll book, sales systems, the profit-and-loss statement, and the balance sheet. The forms not standardized are illustrated for several purposes, namely, to illustrate clearly a particular principle; to help in a clear understanding of a particular system; and for reference in the changing or designing of new forms.

It might be well to emphasize the fact that it is not the intention to have any of these systems apply to any special or particular kind of manufacturing business, but merely to set forth the principles involved and to exhibit designs as applied to certain conditions in manufacturing. In the devising of a system, these methods may then be adopted with the changes that would be necessary according to peculiar conditions.

In a system of this character, the following forms may be used, as before: Purchase requisition, Fig. 57; purchase order, Fig. 58; report of material received, Figs. 59 and 60; and raw-material stock card, Fig. 61.

Production Order and Cost Sheet

The number of copies of the production order required will depend entirely on the use that is made of this form in a particular plant. In general, the original would give a brief description of the order to manufacture. The short copies would be sent to the foreman of the first operating department. The duplicate should remain in the office, and is intended for the purpose of ascertaining the time, in hours, chargeable to the order according to each operation or process. The postings to this form, so far as labor is concerned, would be made from the time reports, which must show the order number, the operation or operating department, as well as the time. No distinction is made between employes or their daily wages in posting the data to the production order. All that is necessary is to enter the number of hours for each operation or machine or operating department. At the end of the cost period, the total time appearing in each operation column would be ascertained and the process or machine rate entered, this information being obtained from the process or machine-cost record, which is explained later. The total number of hours multiplied by the rate per hour of each operation will give the process or machine cost chargeable to the order according to machine, operation, or department. The totals of these operations added together will give the total cost of the operations chargeable to the order, and will include indirect or overhead expenses, as is explained

under the heading Process Cost Records. The cost of the material used should be entered on this order from the material requisition.

Time Report

The labor cost shown by the time cards is summarized according to process or machine number, and becomes a part of the machine or process rate. If several machines of the same kind are in operation, they may be grouped together, and the total labor cost shown by these time reports as chargeable to a process or machine entered at the end of the week or the month on the machine or process-cost record. The group of machines or process is, in effect, an operating department. The total number of operating hours shown by all these time reports represents the same number of hours and minutes charged separately to each order. Entries are made, of course, in the pay-roll book daily so as to ascertain the amount of wages due to each employe. This distribution of time, however, must be accurate, as the total amount charged in these cost records against the several operations must correspond with the total amount of the pay roll for the week or the month. This is important if accurate results are to be obtained and a balancing system kept in operation.

Pay Roll

If a record of time can be kept along the lines laid down, it will be seen at once that the amount of direct labor increases in this system; whereas, the indirect labor, as well as the maintenance, is less. This is due to the fact that more labor can be charged against a machine or process than can be charged to the product direct; and herein, as well as in other respects, this system, in places where it can be installed, is to be preferred to the other. The direct labor appearing in this pay roll should be verified with the machine and process cost records in order to prove the accuracy of the distribution.

Finished-Product Stock Card

The explanation used in the description of the finished-product stock card applies in this system.

The information for this record is obtainable from the time reports, so far as hours and labor cost are concerned; from the material requisitions for supplies used; and from the general books for all the other items except power.

The labor charges should be obtained by sorting all the time reports relating to the same operation and ascertaining the total

labor chargeable to the operation, as well as the number of operating hours and minutes charged to the various order numbers shown on the time report.

After this has been done, the supplies chargeable to each process or operating department should be ascertained and entered against the operation chargeable.

The next element of cost relates to power, provided the operation is performed on a machine. The rate per horsepower-hour, and not horsepower, should be multiplied by the total operating hours of the machine and the amount entered as the cost of power. It is clear that it would be unfair to distribute power cost against the machine merely on the basis of horsepower, as the machine might not, and very likely would not be, operating full time.

The next item relates to floor space, which is obtained from the general books in the following manner: The total floor space of the plant should be ascertained by departments and should be reduced to square feet. Then the amount of rent paid, or the equivalent to rent, should be divided by the total number of square feet and the rate per square foot ascertained. The space occupied by each machine or process should then be calculated; this number multiplied by the cost per square foot will give the amount to be charged in this form as floor space.

If the property and plant are owned by the individual or company operating the plant, the amount of rental equivalent should be ascertained by taking into consideration interest, taxes, maintenance of buildings, insurance on buildings, the cost of ground maintenance, and any other items that may relate to the cost of maintaining the grounds and buildings.

The next item appearing is that of maintenance. This cost is obtained in part from the time reports and in part from any material used from the requisition just mentioned, the total being entered against the operation to which the repairs relate.

The item license can be obtained from the general books; it represents charges made in some states and cities for the privilege of operating certain kinds of machines. Where this applies, it should, of course, be charged to the machine.

The depreciation appearing in this form is taken from a regular schedule after it has been calculated, and the same amount may be entered each month, as the total of all these charges to the operations for depreciation will appear in the general books. The methods of treating depreciation have been given previously; nevertheless, it might be well to outline here the customary way of calculating it. Estimate the life of a

particular machine based on running full time. Then ascertain the amount of the depreciation per hour, and charge the machine, at this rate, for the actual working hour. If this is done, the amount of depreciation charged to the machine will be different each month, as will also the total amount of depreciation appearing in the general books. More accurate results will be obtained, however, because, as must be admitted, depreciation is based on the number of hours that the machine actually works. This does not mean that a machine may not depreciate in value and in fact become worthless, due, perhaps, to modern inventions, but as the term is generally understood, it does apply.

The insurance charged to the machine is based on the average rate of the various insurance companies, and can be taken from the insurance policies, a schedule being prepared that will answer until the insurance rates are changed. The total of the insurance so charged to the machines or operations must correspond with the entries made in the general books, and it is credited to either a reserve fund or to deferred charges; that is, if the insurance is paid in advance, it should be carried as a deferred charge in the general books, and if the reverse is the case it should be credited to the reserve fund for insurance. When the insurance is paid later, the reserve fund should be charged by this amount.

The next item appearing is that of indirect expenses. These can be obtained by dividing the indirect expenses as shown in the general books by the total direct labor, also shown. The labor charged to each machine or process is then multiplied by the per cent. thus obtained, and the amount entered against the operation or machine; or the total indirect expenses may be divided by the machine hours and the rate per hour ascertained, and this multiplied by the hours charged to each machine or operation will give the amount chargeable to the machine or operation. The conditions existing in a plant will necessarily indicate the method to use.

From the foregoing it will be seen that all the cost relating to manufacturing, except cost of material, has been charged against each operation or machine, and that the total number of hours also appears. The next step, of course, is to ascertain the cost per hour, which is only a matter of division. This being obtained, the manufacturer has a record of the actual cost of operating each machine or of each process in his plant; and with this information all that is necessary is to apply this rate to the various orders passing through any or all these operations by keeping a record of the time each order has consumed in

any particular operation. Then, multiplying the number of hours by the rate per hour, the process, or machine, cost will necessarily be determined, which, as has already been shown, includes the indirect expenses.

Power Cost and Distribution

As has been said, the power cost is distributed among the operating machines on a basis of the cost of a horsepower-hour. The method of arriving at this cost is substantially the same as in the case of the machine or process cost; that is to say, the rental charge, depreciation, insurance, and license, together with any other items, are obtained from the same sources and in the same manner as the items of cost relating to machines and processes. The total of this cost is divided by the total horsepower-hour of all the machines in the plant to find the cost of 1 horsepower-hour. This unit rate, or horsepower cost per hour, should be multiplied by the total horsepower-hours of each machine, and the amount extended in the column headed Power Cost. The total of this column should equal the total shown in the column headed Cost, relating to the analysis of power cost.

Statement of Profit and Loss

A statement of profit and loss must naturally be prepared from the information contained in the several accounts kept in the ledgers, and as before, all postings in the ledger should be made from the register of accounts payable, the cash book, the register of sales and costs, and the journal, according to the classification of accounts. The accounts used for the profit-and-loss statement are the various sales accounts of the sales departments, in which are entered, on the credit side, the sales at the selling price, and on the debit side the cost of the goods sold for the same period.

Thus, it will be observed that three of the elements already appear in this account; that is, the sales at the selling price, the cost price, and the balance, or difference, representing the gross profit on goods sold in each of the departments. The other information relates to the selling expenses and administrative expenses of conducting the business, which expenses are posted in the ledger from the register of accounts payable, the journal, or the cash book. If these accounts are divided, that is to say, if several selling and administrative accounts are opened, then the subaccounts should be closed into the general accounts and the total of each of the two main expense accounts prorated or distributed among the sales accounts or sales departments on the

basis of business done at the cost price. After this transfer has been made, each department will show the amount of selling expenses, as well as the amount of administrative expenses charged to it, and the department account will then indicate the net profit on the corresponding line of goods.

All the balances now shown in the department account, which means the net profits for each department, should be transferred to the general profit-and-loss account, and these accounts, that is, the department accounts, ruled off. If there are any other items of profit of a miscellaneous character entering in the profit-and-loss account, they may be included in the statement as miscellaneous income and added to the net profit from operating, which statement will then show the profit from all sources. The net result shown by this statement should, of course, correspond with the amount appearing in the balance sheet.

PRODUCT SYSTEM

Productive-Labor Method

A product system based on the productive-labor method of cost finding is meant to apply to conditions where the product is manufactured and carried in stock from which customers' orders are filled.

There are certain classes of business in which it would be impossible to carry the costs on a particular production order for a particular customer from the time the costs first begin to accumulate, e. g. a tannery or a tobacco business. In both of these industries, while raw material may be purchased for the purpose of filling certain orders or for the manufacture of a distinct article, yet, in the beginning processes, it would be impossible to determine the exact classification of the material.

It might be well at this point to emphasize the fact that there are many kinds of manufacturing in which it is absolutely necessary to use both the special-order and the product system. In most of these cases the product system would be used up to a certain point in the manufacture and covering a certain number of operating departments, after which the special-order system would have to be introduced.

It may also be well to bear in mind that both the productive-labor method and the machine-cost method must often be used in the same plant.

Whether or not one of these plans as a unit is to be introduced in a plant, or a plan comprising certain parts of each plan, is a question that can be determined only by the individual

case. The principal difference between this system and the special-order system, according to the productive-labor method of cost finding, lies in the fact that in this sysetm the cost is obtained according to article, irrespective of production order numbers; whereas, in the other case, costs are charged against a particular order number.

In illustrating this system, the indirect expenses are determined by the operating department, while in the first system this information was obtained as applying only to the factory as a whole. This does not mean, however, that the information could not have been obtained by the operating department in the former system. The method of applying indirect costs to the factory as a whole was illustrated merely for the purpose of showing this method of distribution of indirect expenses in cost finding. The method described in this system is more complete and will naturally insure a more accurate distribution of indirect expenses.

The purchase requisition and the purchase order, as heretofore explained, may be introduced, or any form of a similar character may be used.

Report of Material Received

The introduction of a report of material received in a product system will depend entirely on the class of raw material received, and whether or not it is desirable to apportion the charges on the material-received sheet rather than on some other record. It will also depend on whether the goods are bought f. o. b. shipping point or not. If they are, the question is, as before, whether or not the freight charges would be of sufficient importance.

A raw-material stock record, a factory or production order, and a material requisition similar in form to those used in other methods of cost accounting are required.

The report of material delivered makes it possible to ascertain the total amount of material delivered from the storeroom during the month, according to article and chargeable to a particular department, as well as to determine the name of the product for which the material was used and to which it should be charged. The totals shown by this report, after the cost price has been entered and the extensions made, should be transferred to the stock record for raw material, according to the article. After this has been done, a charge should be made in the cost sheet for the amount of material chargeable to the product or to the article manufactured from this material. The

total amount of material used in any one department should be entered in the operating ledger from the report to the credit of the storeroom account, and to the debit of the department in which the material was used.

Day-Work and Piece-Work Reports

A time report could be used with propriety in this product system. This form will be found to be an advantage in a plant where the employes are engaged part of the time on day work and part of the time on piece work. Two separate forms may be used, however, if desired. In any event, the time reports should be entered, after being duly approved, in the pay-roll records, and also entered in the cost record and charged on the cost sheet to the proper article shown in the time report.

As this system is based on the productive-labor method, it will be necessary to extend the time of each employe by entering the rate of pay and extending the amount, but care must be taken in posting these labor charges to the cost sheet to indicate the department in which the work was done.

As the indirect expenses will not be distributed on the total labor, but on the amount of labor in each department, separate percentages for each department must be computed.

Cost Record

A separate cost sheet is kept for each manufactured article. All the labor charges should be taken from the time reports, and this labor should be entered according to department, so that the indirect expenses may be distributed over the labor of each department. When used in this way the heading Operation in the form is equivalent to operating department. It may prove more convenient, however, to have two sets of cost sheets, one for each article and one for each department. The summaries of each sheet may then be posted to the factory ledger without any further analysis. The production should also be entered under the heading Labor in the column headed Quantity; the material cost can be taken from a requisition, but, preferably, from the report of material delivered. After the indirect expenses for each department have been entered, based on the amount of labor charged, the total of the three elements of cost should be entered in the column headed Total Cost.

Suppose that $12.50 is charged to an article for labor, $5 of which emanates from department A, and $7.50 from department B. If the expenses in department A are calculated as 50 per cent., $2.50 would be charged for indirect expenses to

the article for work done in that department; and, on the other hand, if the expenses in department B figure 100 per cent., the expenses charged for work done in this department would be $7.50. These comparisons also serve to illustrate the method of entering the indirect expenses, as well as to show the importance of dividing the expenses according to departments and the effect that it usually will have on proving the accuracy of the cost.

At the end of the month, after the totals have been entered for the articles finished, as shown by the production report for finished product, the cost should be entered on this record for the amount actually expended, and the cost sheet reduced both as to quantity and cost for the amount so finished. The balance, representing goods in process of manufacture, is brought down for the next month, and this balance should indicate the quantities and costs in the various operations or departments.

Production Report

The report should be made out by the superintendent, the foreman, the stock clerk, or some other individual under the immediate supervision of the superintendent or the manager of the factory. The report relates to finished product only, but it may be used to show the production of a particular department or operation, as well. Twenty-seven columns are provided for the working days of the month. The dates should be entered at the top of these columns, and a list of the articles manufactured should be printed on the left of the form under the heading Articles. The daily production of each of the articles listed should be entered in these columns, and the total for the month extended in the total column. After this report has been approved by the superintendent or the manager of the factory, the cost of each article, as shown in the cost record, is entered in the column headed Rate, and the amount or total cost of each article produced during the month is extended in the column headed Amount. All the articles finished should then be transferred or posted according to article from this report to the finished-stock record.

Stock Record of Finished Product

A separate sheet should be used for each kind of article carried in stock. The inventory at the beginning of the period when this system is installed should be shown, both as to quantity and inventory cost, and the rate indicated. All the information relating to production can be obtained from the produc-

tion report just mentioned. As each of these entries is made, the balance should be increased to correspond. The unfilled orders on hand at the time the system is installed should also be entered according to article; and any orders received from customers for this particular article should be entered in columns provided for that purpose. If any of these orders are canceled before the goods have been shipped, this fact should also be indicated in a column headed Unfilled Orders. The information relating to sales at both the selling price and the cost price can be obtained from the sales sheet at the end of the cost period. The balance of stock on hand, of course, should be changed as the entries are made, and care should be taken in reducing this balance at the end of the period to use the cost price of the goods sold, and not the selling price.

Defective-Work Report

The defective-work report is used to bring to light defective work or shop errors that usually occur in every plant, the object being to ascertain the cause and to reduce the amount of such work or loss to a minimum. The disposition of defective work will depend on the nature of the business. It can be charged either to a defective-work account and included in the indirect expenses or to the product for which it was intended, which will increase the average cost per article of that product. Where some of the material is reclaimed from defective work, the difference between the cost of the work spoiled and the amount received or the value of the reclaimed stock can be charged according to either method mentioned. If part of the stock is to be used again in manufacturing, this should of course be transferred to the stock records for raw materials.

A statement of factory expenditures should be used in any complete system of cost finding where the distribution of indirect expenses are based on productive-labor cost.

Operating Ledger

The use of the ledger serves to reduce the size of the voucher register or register of accounts payable, since the accounts appear in analytical form. This eliminates the numerous special columns that the register of accounts payable would otherwise have to contain in order to save posting. The object of having these special columns in the accounts-payable register is to enter therein all the charges relating to a particular account, and to post the total of all these items in one account at the end of

the month, instead of posting each separately. Consequently, if the business is divided into ten or twelve departments, and each department is divided into a number of accounts showing an analysis of the expenditures or charges, it can be seen that a register of accounts payable provided with all these columns would necessarily be too awkward to handle. For this reason, if for no other, a distribution book, or operating ledger, should be used where these conditions exist.

A separate sheet should be used for each department, and all the accounts relating to each department should be entered at the head or top of the several columns—thirteen in all—appearing on this form. The posting to these departments should be done from the back of the voucher, described later, for all the amounts appearing in that column under the heading Operating Ledger. It will be observed that the columns on the voucher read, Department, Account Number, and Amount, and are intended to be used to indicate the department chargeable, which should be designated by a letter, and the name of the account indicated by a number.

These same account numbers and the department letters should appear on this sheet; that is, at the top of the columns reading from left to right. The accounts may be headed Material—No. 1, Direct Labor—No. 2, Indirect Labor—No. 3, etc., meaning, of course, that account No. 1, where it appears on the back of the voucher, should be entered in the column headed Material for the proper department indicated by letter on the back of the voucher.

When all the postings have been made to these various departments in this record, not only from the vouchers, but also from the other books of account, and the amounts entered in the several columns according to the account chargeable appearing at the top of the column, the totals for the month should be entered and this sheet ruled off. After these totals have been proved, or balanced, with the factory account kept in the general ledger, this account will include all the operating department costs kept in the ledger or distribution book, but not the selling and administrative expenses that appear separately in the general ledger.

After these accounts have been balanced with the details shown in the various columns or accounts, the result of the entries for the month for each department should be transferred to a summary sheet, using the same design. The columns are then headed January, February, etc., for the fiscal year, and the last column is headed Total. At the left-hand side of this form

should be entered, reading from the top of the sheet downward, the names of the various accounts relating to this department that appeared on the previous sheet at the top of the column. The amounts that were entered, so far as the total only is concerned, should be transferred to this summary sheet and entered in the column according to the month in which the entries or transactions occur, opposite the proper account. At the end of the year, the total for each of these accounts should be entered in the column headed Total, so as to show the total expense of this description for the year in each department.

After these summaries have been made up for each department, a summary sheet should be prepared. This sheet, in effect, is a trial balance, showing the departments at the head of the sheet and the various accounts on the side of the sheet, reading down, in the column provided for that purpose. The total of all these department sheets and accounts should be balanced with the controlling account kept in the general ledger; that is to say, the factory account will include all the department costs and accounts, and the total amount should correspond with the balance of the factory account in the general ledger.

Attention is called to the fact that a separate department should be established for power, and this expense distributed among the various operating departments of the factory at the end of each month, on the basis of horsepower consumed in each department; that is, either consumed or indicated.

Factory Selling Price

Attention is called to one principle involved in making a complete distinction or separation between the factory and the sales department; that is, the accounts may be so kept as to have all the profit shown in the various sales accounts or departments, which means kind of goods sold, by including or entering on the sales sheet the actual cost of product manufactured and giving the factory credit at cost, and showing in the factory account only the value of the inventory, no profit whatever appearing.

The other method consists in establishing a standard price at which the various articles manufactured by the factory shall be sold, theoretically speaking, to the sales department by the factory department, just the same as if they were separate and distinct individuals or companies. When this plan is followed, the factory account should show a profit or a loss that will represent the difference between what the product was sold for to the sales department and the actual cost of production. The chief

advantage in adopting a plan of this kind, that is, using a fixed or a stated price at which the factory shall be given credit, is that it puts the superintendent in the position of making the factory account show a profit, or at least no loss, provided he approves and accepts the selling prices to the sales department. In addition to this, a plan of this kind is particularly valuable where the product could be bought in the open market, possibly at these factory prices if not actually cheaper; and the result will show at the end of the year whether the factory is able to compete with other mills without interfering with the progress of the sales department. For this reason, it puts the management in the position of being able to hold each department responsible for results—the factory for producing the goods at not more than a stated price on the one hand, and the sales department for marketing the output at a price sufficiently above the purchase price from the factory to produce dividends for the company.

Where this plan is adopted, sales sheets should be used, executed in triplicate, or else an extra column should be added to the regular sales sheet, which would make three columns in all, one showing the price at which the goods were sold to customers by the sales department, the other showing the price at which the goods were sold to the sales department by the factory, and the last column showing the actual cost of production. In posting these amounts at the end of the month, the entries should be made as follows: The first column, that is, the selling price relating to customers, should be charged to customers and credited to the regular sales accounts or departments; the factory selling price shown in that column, meaning the price at which the goods were charged to the sales department by the factory, should be credited to a factory sales account and charged to the regular sales account in the general ledger. The cost-price column, showing the actual cost of production, should be credited to the regular factory account, showing the inventory, and charged to the factory sales account just mentioned. In all this, it should be understood that a classification of product is made, and that the term sales department means the various departmental accounts under that general head.

Accounts-Payable Voucher

As its name indicates, this form is for the purpose of obtaining a proper voucher for all entries relative to expenditures connected with the business, and is also used in this instance for purposes of classification. A separate voucher may be used for

all the transactions affecting one individual or company for the entire month, or several vouchers may be made out during the month whenever remittances are made. Attached to this voucher, however, should be a copy of the purchase order showing the goods ordered, a copy of the receiving report showing the goods actually received, and the invoice. These documents should be attached to the voucher for every entry or invoice entered on the voucher. These entries, after being approved, may be made on the voucher as the bills are received; but it is not necessary to make the distribution until the end of the month, or whenever it is desired to make remittances. In such an instance, the invoices attached to the voucher should be analyzed and the department and accounts chargeable entered on the back of the voucher under the general heading Operating Ledger.

Process or Machine-Cost Method

The system now to be described will illustrate the process or machine-cost method as applied to the condition in manufacture outlined in the third system described above.

The principle, as applied to the gathering of the cost data in this system, is the same as the principle applied in the second system; but the forms incident to determining the cost of the article, are not the same.

The difference in the number or design of the forms is caused by the difference in the method of operating, and the condition causing these differences in design should be kept in mind in devising a system. The small and particular details incident to any particular business, such as special columns, technical headings, and names of the forms, constitute a secondary consideration in designing a system. The object or principle involved, as well as the kind of information to be obtained, and the manner of obtaining it so far as it relates to the basic principles underlying the system, are the main features to be considered.

In this instance it is assumed that a standard line of product is manufactured, and that the operations are well defined and their relation to the product manufactured definite. The principle involved necessitates a method of obtaining the expenditures or costs chargeable to each operation or machine, as well as the operating hours of each. With this information, the cost of operation per hour can be ascertained. The length of time consumed in the manufacture of each article produced in each of these operations should next be determined. This time may be multiplied by the cost per hour shown, which will then show

the cost. The operating hours, together with the cost relating to the machine or process, form the basis of this plan. In a system of this kind, the basis need not necessarily be time. In some instances this is not practical. As an illustration, the total

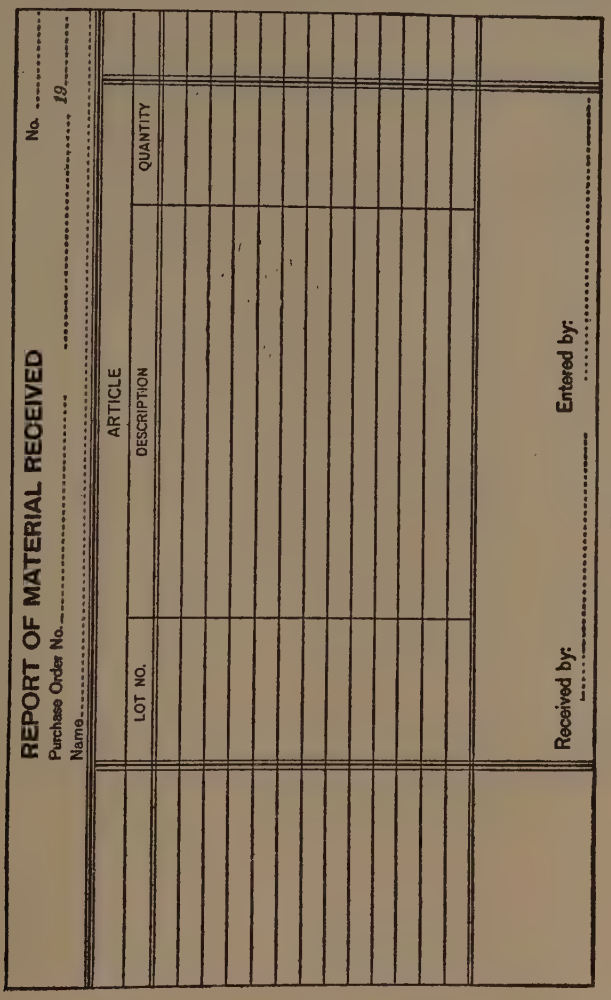


FIG. 63

number of pounds, tons, or any other unit of measure may be used, and the cost per pound or per ton for each operation ascertained. This rate is charged to the articles produced by multiplying the total pounds or tons of each by the cost per pound, per ton, etc. Therefore, the basis of a system of this kind may

REPORT OF MATERIAL RECEIVED

Purchase Order No. ..... 19.... No. .....

Name .....

ARTICLE			COST			
LOT NO.	DESCRIPTION	QUANTITY	INVOICE	DISTRIBUTION CHARGES	TOTAL	RATE

CHARGES		OPERATING LEDGER			
DESCRIPTION	AMOUNT	ACCOUNT	COLUMN	FOLIO	AMOUNT

Received by: ..... Entered by: .....

FIG. 64

be either time, showing the cost per hour, or quantity, showing the cost of any unit of measure. This applies either to time consumed in the manufacture of an article, regardless of quantity, as a basis; or according to the total unit of measure produced in connection with the cost per unit of measure, regardless of the time consumed. The result by either method, where the conditions admit of it, will be equally accurate.

Purchase Requisition and Purchase Order

In a product system of this character, use should be made of a purchase requisition and a purchase order.

Report of Material Received

The introduction at this time of the report of material received, which is illustrated in Figs. 63 and 64, is merely to

PRODUCTION ORDER No. .....

To Foreman ..... Department Date .....

You are hereby authorized to manufacture the following:

MATERIAL REQUIRED FOR ABOVE ORDER	QUANTITY	RATE	AMOUNT

Received by ..... Authorized by .....

Fig. 65

serve the purpose of showing forms applicable to this particular kind of a system.

A raw-material stock card like those shown before may be used in this product system if desired.

Production Order

In this instance, no material requisition is used, because the production order, Fig. 65, will furnish a report of material used in the production, and at the same time furnish instructions to the factory concerning the kind of product to be manufactured.

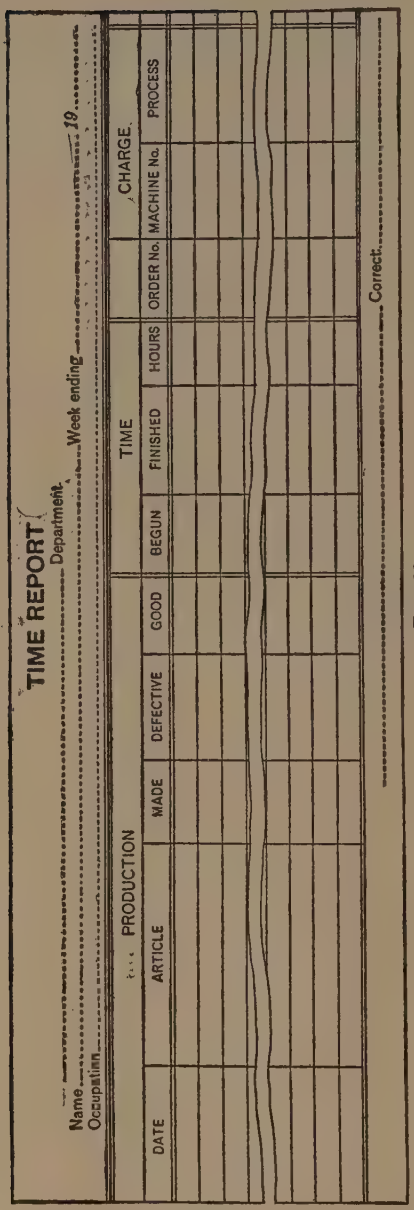


FIG. 66

All posting to the raw-material records for material used should therefore be made from this record; and the total cost of the material should be charged on the cost sheet in total, against the manufactured article for which the material was used. After the raw-material account has been credited and the article charged in the cost record, this form should be filed in a binder and arranged according to the article manufactured from this material.

Time Report

A form similar to that shown in Fig. 66 may be used in connection with gathering data relating to labor costs. These reports may be made out daily or weekly, but the pay-roll form, which follows, is so designed that the posting from the time records may be made daily.

After these reports have been entered in the pay roll, the total time of each employe should be transferred to the analysis of pay roll, which is explained later. In making these transferring entries, only the number of hours and minutes need be entered in the column for the time of each employe, but it must be kept in mind that this time must be entered on the proper analysis of the pay-roll sheet, as a separate sheet is used for each operation

PAY ROLL

For two weeks ending ..... 19 .....

	DEPARTMENT			AMOUNT OF PAY			DISTRIBUTION											
	NO.	ROOM	CLOCK NO.	EARNINGS	DEDUCTIONS	AMOUNT PAYABLE	MON.	TUES.	WED.	THUR.	FRI.	SAT.	MON.	TUES.	WED.	THUR.	FRI.	SAT.

Approved: ..... Correct: .....

FIG. 67

and the employe's number or name is entered at the top of this sheet; that is, at the top of the column, of which there are several. If the time reports are kept on a daily basis, this summary should be made from day to day; but if the time is reported weekly, then it should be entered weekly. At any rate, the total time of each employe for the week, charged in each operation, should correspond with the total number of hours entered in the pay-roll book for the same employe and for the same period of time, as the total of this analysis of pay roll for all these operations for the week or month must correspond and balance with the total shown in the pay-roll book.

Pay Roll

As different pay-roll designs have been presented, it is considered necessary in this case simply to mention the fact that the pay-roll book or form, Fig. 67, required in this method is not provided with columns for dividing or distributing labor into direct and indirect, because this information is shown in detail in the analysis of pay roll, next to be explained, according to operation and employe.

Analysis of Pay Roll

A separate sheet of the analysis of pay roll, Fig. 68, should be used for each operation, and the name or the clock number of each employe entered at the top of the several columns running from left to right appearing on this form; that is, only so far as the employes engaged on operations of this kind are concerned. The information relating to time of employes chargeable to this operation is shown in the time reports of each employe, as has already been shown. At the end of the week or the month the total number of hours and minutes in each of these columns provided for each employe connected with these operations should be shown, and his rate per hour entered. The amount should then be extended at the bottom of the sheet, and the total of all these employes, in hours and minutes, and the labor cost relating to the operations for the week or the month should be ascertained and entered in the machine or process-cost records to be mentioned later.

The total labor cost of all these operations added together, plus the indirect labor, should equal the total amount of the labor shown in the pay-roll book for the same period. This form is not used for any other purposes, and, after this information has been obtained, the object has been accomplished. The form should be filed in a binder according to operations and arranged according to date.

ANALYSIS OF PAY ROLL

Operation..... Month of.....19.....

DATE		CLOCK NO.		CLOCK NO.		CLOCK NO.		CLOCK NO.		CLOCK NO.		TOTAL	
		HOURS	MINUTES	HOURS	MINUTES	HOURS	MINUTES	HOURS	MINUTES	HOURS	MINUTES	HOURS	MINUTES
TOTAL													
RATE													
AMOUNT													

FIG. 68

Production Report

A production report similar to that shown earlier will answer the requirements of this system. It is used for obtaining the total production of the various articles manufactured during the month, in the several operations, including the finished product. A separate report should be made out for each operation, although in the system in which this form was first used it was necessary to report only the finished product.

The total production of each article for each operation, according to this system, should be transferred at the end of the month to the cost sheet, and entered in the proper columns, showing the production according to operation. Where the finished product is shown in the report, it should be entered as a deduction in the cost sheet just mentioned. The total cost, as well as the rate entered in this report, should then be transferred, so far as finished product is concerned, to the finished-stock records, and entered in the column headed Production; the balance should be shown in the stock sheet increased to this amount.

STOCK CARD
FINISHED PRODUCT

Classification No._____
Maximum_____
Article_____ Minimum_____

DATE		PRODUCTION			SHIPMENTS			BALANCE		
		QUANTITY	RATE	AMOUNT	QUANTITY	RATE	AMOUNT	QUANTITY	RATE	AMOUNT

Fig. 69

Finished-Product Stock Record

Should this form be used, it would be unnecessary to use a cost register in addition. However, a form of the same character as that shown in Fig. 69 may be used, and a separate register for the other information provided if desired.

Machine and Process-Cost Record and Power Cost and Distribution

The two forms for the machine and process-cost record and the power cost and distribution to be used in this system are shown in Figs. 70 and 71. They are explained in the second system, and this explanation may be applied in this system to fit the

PROCESS COST RECORD

No.....

.....Department-For the.....

Machine No..... .....Operation.....

DISTRIBUTION							
Time							
Begun							
Finished							
Hours							
Idle							
Machine Costs							
Day Work							
Piece Work							
Supplies							
Power							
Floor Space							
Maintenance							
License							
Depreciation							
Insurance							
Indirect Expenses							
TOTAL							
Cost per hour							

FIG. 70

requirements. The labor cost and the number of hours, however, are taken from the analysis of pay roll described in this system, instead of directly from the time reports, as in the other system.

Cost Record

A cost record such as is shown in Fig. 72 may be designed in two ways: (1) by keeping a separate sheet for each article, and entering the descriptive matter as to time, production, cost,

etc., on the side of the form reading down, and the operations at the top of the sheet reading from left to right, as is shown in this form; or (2) the conditions may be reversed; the reading matter, as well as the ruling of the design, may be arranged differently and several articles entered on one sheet.

All necessary information, so far as time is concerned, can be obtained from a summary of the time reports, according to

POWER COSTS AND DISTRIBUTION

For the month of..... 19....

ANALYSIS	COST	DISTRIBUTION	DEPT.	HORSE-POWER	RUN-NING TIME	H. P. HOURS	POWER COST
Rental Charge		Machine No. 1	A				
Depreciation		Machine No. 2	A				
License		Machine No. 3	A				
Inspection		Machine No. 4	B				
Insurance		Etc.	C				
Fuel			etc.				
Water							
Repairs							
Oil, Waste, etc.							
Engineer							
Firemen							
Incidentals							
TOTAL							
Horsepower Hours							
Horsepower Distributed							
Horsepower Developed							
Horsepower Loss and Transmission							
Cost per Horsepower Hour							

FIG. 71

article and by operation; and the result may be entered in this record and charged to the proper article according to operation. In the production report referred to in this system, the production of each article, according to each operation, is shown, and it should be entered in the same manner as the time. These two factors being obtained, the rate per hour shown in the machine or process-cost records should then be entered and the amount extended, chargeable to the article for each operation, based on the time consumed in each operation. This will then give the

COST SHEET

Article ..... No. .....

DATE		DESCRIPTION		NO. 1			NO. 2			NO. 3			NO. 4			NO. 5		
				HR.	MIN.	QUANTITY	HR.	MIN.	QUANTITY	HR.	MIN.	QUANTITY	HR.	MIN.	QUANTITY	HR.	MIN.	QUANTITY

total process cost of the several operations, to which should be added the material cost, which will then show the total cost of the articles produced during the month according to operation. To this should be added the balance or inventory of goods in process of manufacture at the beginning of the month, from which should be deducted the cost of the articles that have been finished and transferred to the finished-stock records; the sheet will then show the inventory of goods in process of manufacture at the end of the month.

If desired, the production and the cost of each operation may be transferred from one operation to the other until the last operation of finished product has been determined. This involves

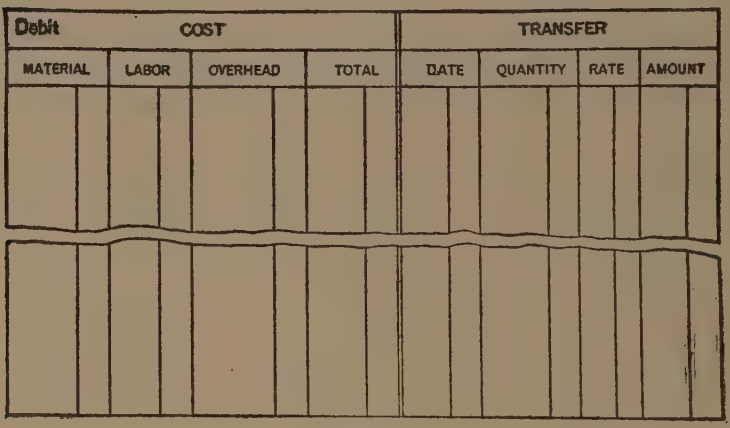


FIG. 73

deducting from each of these operations the cost and the quantity transferred from operation No. 1 to operation No. 2, etc., which means that the amount by which operation No. 1 would be decreased, would, at the same time, increase both the quantity and the cost of operation No. 2, and so on. As a result, the inventory, in quantity and cost, would appear in each of these operations, together with the accumulated cost; whereas, according to the other method, the quantities would appear, but the accrued cost in each operation after the first would not appear. The unit cost according to the operation of the article would, however, be more clearly shown than in the method just mentioned. In either case, so far as the cost is concerned, the result will be the same, but the second method involves more work than the first.

A form of operating ledger similar to that shown in Fig. 73

DAILY ANALYSIS OF SALES AND COST Dated ..... 19....

A		B		C		D		E		F		G		H	
SALES	COST	SALES	COST	SALES	COST	SALES	COST	SALES	COST	SALES	COST	SALES	COST	SALES	COST

I		J		K		L		M		N		O		P	
SALES	COST	SALES	COST	SALES	COST	SALES	COST	SALES	COST	SALES	COST	SALES	COST	SALES	COST

FIG. 74

would answer the requirements of this system. Both of these forms have been explained previously.

Daily Analysis of Sales and Costs

If a number of departments are kept and the sales are classified according to these departments, both at the selling price and the cost price, and if it is not necessary to make a regular abstract of the sales showing to whom sold, sales-sheet number, the amount of the sale, etc., a general summary sheet like that shown in Fig. 74 will be better adapted to these conditions than any other kind of form, provided the sales are active.

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